Ministry of Forests
and
Ministry of Water, Air and Land Protection

FOREST SERVICE • BRITISH COLUMBIA

2002 - 2007

RESOURCE MANAGEMENT PLAN

Volume II

Sustainable Harvest

for the

Prince George Forest/Omineca-Peace Region

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2 SUSTAINABLE HARVEST

2.1 INTRODUCTION

The Prince George Forest Region consists of 6 management units (TSA's) and four TFL's., covering four major biogeoclimatic zones. The guiding silvicultural principles for each unit are, however, common to all, and constitute the regional and provincial position, expressed as follows:

Silvicultural Goals:

- Sustainable Resource Use
- Community Stability
- A Strong Forest Sector

Key Guiding Principles

- Because the distant future cannot be foretold, the best and only course of action in managing the timber resource is that which minimizes risk and maintains options
- Prince George Forests are important locally, provincially, nationally and globally, and should be managed in this context.
- Each generation of northern British Columbian becomes the steward of the region's forest resources and has a moral obligation to preserve this heritage for future generations.

Working Targets

Within the context of the guidling principles:

- Minimize the anticipated interim reduction in timber supply so that management unit harvests may remain as high as possible, consistant with Provincial Timber Supply policy.
- Create a long term timber, steady supply of timber within each management unit.
- Eliminate all pre-1982 good and medium site backlog NSR and all 1982 to 1987 backlog NSR in a reasonable time, specific to the structure of each management unit.
- Over the long term, maintain the production of premium quallty logs at a level appropriate to the production potential of each management unit.

Major Silvicultural Strategies

Identify appropriate silvicultural strategies within each management unit, subject to local silvicultural issues and opportunities.

Strategy Implementation

All TSA's within the Prince George Forest Region have a documented, provisional silvicultural strategy.

Apart from these principles and guiding provincial silvicultural policy, there are no over-riding Regional silvicultural issues or priorities. Rather, the sum of all key, management unit (forest district) silvicultural issues and priorities collectively constitutes the issues and priorities of the Region. Each unit reflects a unique forest structure, management infrastructure, development history and community dependence.

Forest level objectives incorporate public forest values, and reflect resource user demands for specific goods, services and forest conditions. The current structure and future dynamics of the whole forest determines the availability and sustainability of forest values, and the degree to which forest level objectives are achievable. Most forest values are related to one or a combination of the following factors:

- a specific stand type,
- a specific pattern of stand types,
- a specific stage of stand development, or
- a specific pattern of stand development stages.

From the perspective of Sustainable Harvest, resource supply is a function of the initial structure and dynamics of the forest, and the spatial and temporal nature of resource allocation to users. Resource supply problems may result from:

biological factors

Site productivity directly affects stand growth rate and productivity potential. Site productivity and the silvics of the timber species in the forest results in specific patterns of stand development. These biological factors in turn influence management factors such as the length of regeneration period, the pattern and level of volume production the time required for development of a specific stand condition, and the long run sustainable yield (LRSY) of the forest estate. The biological pattern of disease and insect damage and also affects the short term supply of timber and specific habitat conditions.

forest structure factors

The size of the timber production land base of the forest is a major factor affecting LRSY. Also, the distribution of certain stand age classes may affect both timber harvest flow, as well as the availability of critical habitat or biodiversity features or conditions in the forest, all of which are cogent to Sustainable Harvest plans The proportion of NSR in the forest affects the short term timber harvest level, as does the periodic rate of timber losses from fire.

economic factors

The physical geography of the forest estate strongly influences forest management economics. Inaccessible or economically inoperable stands affect the size of the timber harvesting land base, and hence the LRSY. Past or present circumstances which have restricted harvesting to a specific portion of the forest, may result in future reductions in the harvesting land base, and abrupt reductions in LRSY.

integrated resource objectives

Integrated resource management objectives affect the area of forest removed from the timber harvesting land base. Allocations for special non-timber uses, whether permanent or temporary, may result in periodic or long term interruptions in timber flow.

forest policy constraints

Forest practices policies impose constraints, such as harvesting guidelines designed to protect non-timber values, which may result in forest resource supply problems. Examples of these include: opening size and shape restrictions; adjacency and exclusion period (green-up) rules; maximum percentage of area with stands under the exclusion age; minimum percentage of area retained in the larger height classes; old-growth reserves, protection of riparian zones; retention of biodiversity (forest ecosystem networks); snag and green tree retention (within-block diversity); and visual quality objectives. Other policy constraints harvest flows are the maximum permissible rate of declining harvest levels in forests with anticipated timber deficits, and the harvest rules regarding minimum rotation age.

A forest management strategy, not a regional silvicultural strategy, should be the guiding reference for stand level silviculture. The relative "goodness" of a silvicultural intervention is difficult to judge unless viewed within a forest strategy context. Without this contextual linkage, few silvicultural tactics can be objectively evaluated.

Silviculturists in the Prince George Forest Region therefore advocate that a comprehensive forest management strategy is necessary before rational choices of stand level interventions can be made. Without it, one or more of the following risks increases:

- costly silvicultural investments with little or no forest level benefits;
- cumulative forest-level effects which exacerbate a forest management problem;
- large opportunity costs if actual forest management problems are ignored.

Potential silvicultural opportunities identified through forest analysis provide the context for selecting candidate silvicultural practices, and subsequently, possible silvicultural treatments, or treatment regimes (multiple, complimentary treatments). All TSA's within the Prince George Forest Region, as well as TFL 42 have completed the first step towards a forest level silvicultural analysis. Two Forest Districts (Robson Valley and Mackenzie), and TFL 53 are currently undergoing the next phase. TFL 48 is also planning initiation of a Type 2 analysis.

Forest analysis requires thorough knowledge of the structure of the forest, its dynamics and production possibilities, as well local experience in observing and estimating the treatment responses and costs of a wide variety of stand level silvicultural interventions.

A biologically feasible silvicultural intervention may have little or no strategic value unless the cumulative effects of implementing it are significant at the forest level. There must be a sufficiently large stand response, an adequate silvicultural treatment capability, and an appropriate number of structurally suitable stands in the forest to produce the forest level effect required.

There is a mistaken assumption by individuals within governments, resource agencies and organizations that forest analysis is a simple and straightforward mathmatical exercise. Forest analysis is not simple; it operates within a complex and uncertain environment. Higher level plans are complete for most of the region, but forest management objectives are rarely stated in clearly defined, measureable terms. This situation reflects the greater difficulties facing forest policy development:

- the objectives of society are ill-defined;
- the values that society attaches to various forest activities such as recreation or preservation of biodiversity are imprecise at best, or simply not known;
- land use and silvicultural decisions often pertain to an uncertain and distant future;
- there is uncertainty about forest tenures, the macro economy, future forest product prices, and the ability of, or need for governments to reduce deficits/debts.

Compounding the difficulties imposed by societal uncertainty, the effects of silviculture and forest management decisions are often far from certain, both from a biological and socio-economic perspective. The biological realism and subsequent precision of forest analysis depends greatly on the analyst's and user's silvicultural knowledge and experience in the forest under analysis, and the accuracy with which stand responses can be predicted.

In the face of many sources of uncertainty, including measurement error, lack of judgement, imprecision, unreliability, variability, vagueness, ignorance and ambiguity, there is a tendency for silviculturists to reject forest analysis as a practical tool. By comparison, stand-by-stand decision-making offers the appearance of a less complex, more pragmatic and perhaps more satisfying approach to silvicultural investment. "Site-specific" silvicultural treatment prescriptions are often assumed to reflect "good forestry" in the mistaken assumption that stand level effects are additive at the forest level. They usually are not.

In spite of the fact that little can be done to improve forecasts of future markets, human values or social needs, thoughtful and biologically realistic forest analysis provides a means of dealing with management uncertainty. A greater appreciation and understanding of forest dynamics will enable forest managers and public forest users to see the probable future outcomes of forest management options, thereby allowing present day choices to be made, and permitting timely planning and implementation of silvicultural investments and interventions.

2.2 REGIONAL SUSTAINABLE HARVEST SUMMARY

2.2.1 ENHANCED FORESTRY PROGRAM SUMMARY

Activities	Treatment Area Goals (ha)					Plan 2002/03	
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Surveys	**3,450**	**3,450**	**1,869**	**1,568**	**1,646**	**27.25**	**94,000**
Pr. Geo. Supply Block	1,000	1,000	1,000	1,000	1,000	30.00	30,000
Vand. Supply Block	1,000	1,000	319	18	96	20.00	20,000
Ft.St. Jms Supply Block	450	450	450	450	450	24.44	11,000
Robson TSA	1,000	1,000	100	100	100	33.00	33,000
Mackenzie TSA	0	0	0	0	0	0.00	0
Dawson Creek TSA	0	0	0	0	0	0.00	0
Ft. St. John TSA	0	0	0	0	0	0.00	0
Fort Nelson TSA	0	0	0	0	0	0.00	0
Woodlots	0	0	0	0	0	0.00	0
Surveys Total	3,450	3,450	1,869	1,568	1,646	27.25	94,000
Spacing	**1,444**	**1,600**	**1,600**	**1,600**	**1,600**	**679.36**	**981,000**
Pr. Geo. Supply Block	300	500	500	500	500	700.00	210,000
Vand. Supply Block	862	740	740	740	740	650.00	560,300
Ft.St. Jms Supply Block	136	260	260	260	260	700.00	95,200
Robson TSA	50	50	50	50	50	950.00	47,500
Mackenzie TSA	0	0	0	0	0	0.00	0
Dawson Creek TSA	0	0	0	0	0	0.00	0
Ft. St. John TSA	0	0	0	0	0	0.00	0
Fort Nelson TSA	0	0	0	0	0	0.00	0
Woodlots	96	50	50	50	50	708.33	68,000
Spacing Total	1,444	1,600	1,600	1,600	1,600	679.36	981,000
Pruning	**127**	**100**	**100**	**100**	**100**	**1,070.85**	**136,000**
Pr. Geo. Supply Block	50	50	50	50	50	1,000.00	50,000
Vand. Supply Block	50	50	50	50	50	1,100.00	55,000
Ft.St. Jms Supply Block	0	0	0	0	0	0.00	0
Robson TSA	20	0	0	0	0	1,200.00	24,000
Mackenzie TSA	0	0	0	0	0	0.00	0

Dawson Creek TSA	0	0	0	0	0	0.00	0
Ft. St. John TSA	0	0	0	0	0	0.00	0
Fort Nelson TSA	0	0	0	0	0	0.00	0
Woodlots	7	0	0	0	0	1,000.00	7,000
Pruning Total	127	100	100	100	100	1,070.85	136,000
Fertilizing	**670**	**733**	**1,013**	**1,000**	**1,400**	**355.22**	**238,000**
Pr. Geo. Supply Block	300	300	600	600	1,000	300.00	90,000
Vand. Supply Block	350	400	400	400	400	400.00	140,000
Ft.St. Jms Supply Block	0	33	13	0	0	0.00	0
Robson TSA	0	0	0	0	0	0.00	0
Mackenzie TSA	0	0	0	0	0	0.00	0
Dawson Creek TSA	0	0	0	0	0	0.00	0
Ft. St. John TSA	0	0	0	0	0	0.00	0
Fort Nelson TSA	0	0	0	0	0	0.00	0
Woodlots	20	0	0	0	0	400.00	8,000
Fertilizing Total	670	733	1,013	1,000	1,400	1,100.00	238,000
Other	**0**	**0**	**0**	**0**	**0**	**0.00**	**0**
Pr. Geo. Supply Block	0	0	0	0	0	0.00	0
Vand. Supply Block	0	0	0	0	0	0.00	0
Ft.St. Jms Supply Block	0	0	0	0	0	0.00	0
Robson TSA	0	0	0	0	0	0.00	0
Mackenzie TSA	0	0	0	0	0	0.00	0
Dawson Creek TSA	0	0	0	0	0	0.00	0
Ft. St. John TSA	0	0	0	0	0	0.00	0
Fort Nelson TSA	0	0	0	0	0	0.00	0
Woodlots	0	0	0	0	0	0.00	0
Other Total	0	0	0	0	0	0.00	0
Totals hectares	**5,691**	**5,883**	**4,582**	**4,268**	**4,746**	**254.61**	**1,449,000**
Planning and prescriptions							**82,500**
Pr. Geo. Supply Block							50,000
Vand. Supply Block							20,000
Ft.St. Jms Supply Block							0
Robson TSA							7,500
Mackenzie TSA							0
Dawson Creek TSA							0
Ft. St. John TSA							0
Fort Nelson TSA							0
Woodlots							5,000
Plan./Prescr. Total							82,500
Total dollars							**1,531,500**

Forest Health Enhancement

Spacing	**0**	**0**	**0**	**0**	**0**	**0.00**	**0**
Pr. Geo. Supply Block	0	0	0	0	0	0.00	0
Vand. Supply Block	0	0	0	0	0	0.00	0
Ft.St. Jms Supply Block	0	0	0	0	0	0.00	0
Robson TSA	0	0	0	0	0	0.00	0
Mackenzie TSA	0	0	0	0	0	0.00	0
Dawson Creek TSA	0	0	0	0	0	0.00	0
Ft. St. John TSA	0	0	0	0	0	0.00	0
Fort Nelson TSA	0	0	0	0	0	0.00	0
Woodlots	0	0	0	0	0	0.00	0
Spacing Total	0	0	0	0	0	0.00	0

Pruning	**100**	**100**	**100**	**100**	**100**	**1,199.93**	**120,000**
Pr. Geo. Supply Block	0	0	0	0	0	0.00	0
Vand. Supply Block	0	0	0	0	0	0.00	0
Ft.St. Jms Supply Block	100	100	100	100	100	1,200.00	120,000
Robson TSA	0	0	0	0	0	0.00	0
Mackenzie TSA	0	0	0	0	0	0.00	0
Dawson Creek TSA	0	0	0	0	0	0.00	0
Ft. St. John TSA	0	0	0	0	0	0.00	0
Fort Nelson TSA	0	0	0	0	0	0.00	0
Woodlots	0	0	0	0	0	0.00	0
Pruning Total	100	100	100	100	100	1,199.93	120,000
Other treatments	**0**	**0**	**0**	**0**	**0**	**0.00**	**0**
Totals hectares	**100**	**100**	**100**	**100**	**100**	**1,199.93**	**120,000**

Habitat Supply and Biodiversity Enhancement

Riparian treatments	**0**	**0**	**0**	**0**	**0**	**0.00**	**0**
Pr. Geo. Supply Block	0	0	0	0	0	0.00	0
Vand. Supply Block	0	0	0	0	0	0.00	0
Ft.St. Jms Supply Block	0	0	0	0	0	0.00	0
Robson TSA	0	0	0	0	0	0.00	0
Mackenzie TSA	0	0	0	0	0	0.00	0
Dawson Creek TSA	0	0	0	0	0	0.00	0
Ft. St. John TSA	0	0	0	0	0	0.00	0
Fort Nelson TSA	0	0	0	0	0	0.00	0
Woodlots	0	0	0	0	0	0.00	0
Riparian Total	0	0	0	0	0	0.00	0
Non-riparian treatments	**0**	**0**	**0**	**0**	**0**	**0.00**	**0**
Pr. Geo. Supply Block	0	0	0	0	0	0.00	0
Vand. Supply Block	0	0	0	0	0	0.00	0
Ft.St. Jms Supply Block	0	0	0	0	0	0.00	0
Robson TSA	0	0	0	0	0	0.00	0
Mackenzie TSA	0	0	0	0	0	0.00	0
Dawson Creek TSA	0	0	0	0	0	0.00	0
Ft. St. John TSA	0	0	0	0	0	0.00	0
Fort Nelson TSA	0	0	0	0	0	0.00	0
Woodlots	0	0	0	0	0	0.00	0
Non-Riparian Total	0	0	0	0	0	0.00	0
Totals hectares	**0**	**0**	**0**	**0**	**0**	**0.00**	**0**

Domestic Range

Treatments	**0**	**0**	**0**	**0**	**0**	**0.00**	**0**

Enhanced Forestry Activities - Prince George Forest Region Total

Surveys	3,450	3,450	1,869	1,568	1,646	27.25	94,000
Spacing	1,444	1,600	1,600	1,600	1,600	679.36	981,000
Pruning	227	200	200	200	200	1,127.71	256,000
Fertilizing	670	733	1,013	1,000	1,400	355.22	238,000
Other stand tending activities	0	0	0	0	0	0.00	0
Totals hectares	5,791	5,983	4,682	4,368	4,846	270.94	1,569,000

Planning and prescriptions	0.00	82,500
Studies funding		25,000
Pr. Geo. Supply Block		25,000
Vand. Supply Block		0
Ft.St. Jms Supply Block		0
Robson TSA		0
Mackenzie TSA		0
Dawson Creek TSA		0
Ft. St. John TSA		0
Fort Nelson TSA		0
Woodlots		0
Studies Total		25,000
Total dollars		1,676,500

2.2.2 BACKLOG FORESTRY PROGRAM SUMMARY

Activities		Treatment Area Goals (ha) 2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Plan 2002/03 Unit Cost ($/ha)	Funding ($)
Legal Obligations								
Surveys		**5,542**	**5,931**	**7,653**	**7,591**	**4,390**	**32.97**	**182,73**
	Pr. Geo. Supply Block	500	500	1,000	1,000	1,000	25.00	12,50
	Vand. Supply Block	247	161	63	81	0	30.00	7,41
	Ft.St. Jms Supply Block	500	350	275	150	150	23.75	11,87
	Robson TSA	0	30	50	50	50	0.00	
	Mackenzie TSA	750	1,500	2,875	2,750	0	40.00	30,00
	Dawson Creek TSA	1,100	1,100	1,100	1,100	1,100	40.00	44,00
	Ft. St. John TSA	1,740	1,740	1,740	1,740	1,740	25.86	45,00
	Fort Nelson TSA	550	550	550	720	350	40.00	22,00
	Woodlots	155	0	0	0	0	64.20	9,95
	Total	5,542	5,931	7,653	7,591	4,390	32.97	182,73
Site preparation		**458**	**300**	**300**	**300**	**300**	**771.21**	**353,21**
	Pr. Geo. Supply Block	0	0	0	0	0	0.00	
	Vand. Supply Block	0	0	0	0	0	0.00	
	Ft.St. Jms Supply Block	0	0	0	0	0	0.00	
	Robson TSA	0	0	0	0	0	0.00	
	Mackenzie TSA	0	0	0	0	0	0.00	
	Dawson Creek TSA	300	300	300	300	300	750.00	225,00
	Ft. St. John TSA	0	0	0	0	0	0.00	
	Fort Nelson TSA	100	0	0	0	0	580.00	58,00
	Woodlots	58	0	0	0	0	1,210.66	70,21
	Total	458	300	300	300	300	771.21	353,21
Planting		**885**	**595**	**525**	**545**	**545**	**624.26**	**552,46**
	Pr. Geo. Supply Block	100	100	100	100	100	450.00	45,00
	Vand. Supply Block	7	0	0	0	0	550.00	3,85
	Ft.St. Jms Supply Block	75	0	0	0	0	300.00	22,50
	Robson TSA	0	0	30	50	50	0.00	
	Mackenzie TSA	50	0	0	0	0	700.00	35,00
	Dawson Creek TSA	395	395	395	395	395	540.00	213,30
	Ft. St. John TSA	0	0	0	0	0	0.00	
	Fort Nelson TSA	200	100	0	0	0	1,000.00	200.00
	Woodlots	58	0	0	0	0	565.83	32,81
	Total	885	595	525	545	545	624.26	552,46

Brushing		**3,197**	**2,741**	**2,566**	**2,546**	**2,126**	**652.59**	**2,086,34**
	Pr. Geo. Supply Block	200	200	200	200	200	700.00	140,00
	Vand. Supply Block	15	0	0	0	0	650.00	9,75
	Ft.St. Jms Supply Block	35	25	0	0	0	750.00	26,25
	Robson TSA	0	0	0	30	50	0.00	
	Mackenzie TSA	830	550	500	450	10	795.18	660,00
	Dawson Creek TSA	1,666	1,666	1,666	1,666	1,666	550.00	916,30
	Ft. St. John TSA	200	200	200	200	200	400.00	80,00
	Fort Nelson TSA	200	100	0	0	0	0.5/tree	200,00
	Woodlots	51	0	0	0	0	1,059.61	54,04
	Total	3,197	2,741	2,566	2,546	2,126	652.59	2,086,34
Max. density spacing		**529**	**310**	**310**	**310**	**310**	**886.76**	**469,10**
	Pr. Geo. Supply Block	0	0	0	0	0	0.00	
	Vand. Supply Block	84	0	0	0	0	650.00	54,60
	Ft.St. Jms Supply Block	135	0	0	0	0	700.00	94,50
	Robson TSA	0	0	0	0	0	0.00	
	Mackenzie TSA	0	0	0	0	0	1,000.00	
	Dawson Creek TSA	260	260	260	260	260	1,000.00	260,00
	Ft. St. John TSA	0	0	0	0	0	0.00	
	Fort Nelson TSA	0	0	0	0	0	0.00	
	Woodlots	50	50	50	50	50	1,200.00	60,00
	Total	529	310	310	310	310	886.76	469,10
	Totals hectares	10,611	9,877	11,354	11,292	7,671	343.40	3,643,86
Seed purchase		**745**	**595**	**495**	**495**	**495**	**421.14**	**313,75**
	Pr. Geo. Supply Block	100	100	100	100	100	450.00	45,00
	Vand. Supply Block	0	0	0	0	0	0.00	
	Ft.St. Jms Supply Block	0	0	0	0	0	0.00	
	Robson TSA	0	0	0	0	0	0.00	
	Mackenzie TSA	50	0	0	0	0	200.00	10,00
	Dawson Creek TSA	395	395	395	395	395	250.00	98,75
	Ft. St. John TSA	0	0	0	0	0	0.00	
	Fort Nelson TSA	200	100	0	0	0	800.00	160,00
	Woodlots							
	Total	745	595	495	495	495	421.14	313,75
	Total legal obligations							3,957,61

Backlog Reforestation

Surveys		**28,275**	**24,020**	**17,319**	**12,243**	**12,120**	**29.12**	**823,25**
	Pr. Geo. Supply Block	20,000	18,000	12,000	7,000	7,000	30.00	600,00
	Vand. Supply Block	300	300	49	23	0	30.00	9,00
	Ft.St. Jms Supply Block	2,900	1,400	1,200	1,200	1,200	23.00	66,70
	Robson TSA	200	100	50	0	0	25.00	5,00
	Mackenzie TSA	0	0	0	0	0	0.00	
	Dawson Creek TSA	200	200	200	200	200	25.00	5,00
	Ft. St. John TSA	2,880	2,880	2,880	2,880	2,880	26.04	75,00
	Fort Nelson TSA	340	340	340	340	340	40.00	13,60
	Woodlots	1,455	800	600	600	500	33.64	48,95
	Total	28,275	24,020	17,319	12,243	12,120	29.12	823,25
Site preparation		**2,133**	**1,825**	**1,825**	**1,825**	**1,825**	**558.96**	**1,192,25**
	Pr. Geo. Supply Block	500	500	500	500	500	800.00	400,00
	Vand. Supply Block	50	0	0	0	0	900.00	45,00
	Ft.St. Jms Supply Block	0	0	0	0	0	0.00	
	Robson TSA	150	50	50	50	50	800.00	120,00
	Mackenzie TSA	0	0	0	0	0	0.00	
	Dawson Creek TSA	125	125	125	125	125	750.00	93,75
	Ft. St. John TSA	1,000	1,000	1,000	1,000	1,000	336.29	336,29
	Fort Nelson TSA	150	100	100	100	100	580.00	87,00
	Woodlots	158	50	50	50	50	697.58	110,21
	Total	2,133	1,825	1,825	1,825	1,825	558.96	1,192,25
Planting		**2,622**	**3,145**	**2,650**	**2,545**	**2,545**	**380.52**	**997,71**
	Pr. Geo. Supply Block	100	600	600	500	500	450.00	45,00
	Vand. Supply Block	50	50	0	0	0	550.00	27,50
	Ft.St. Jms Supply Block	569	590	245	240	240	300.00	170,70
	Robson TSA	40	150	50	50	50	450.00	18,00
	Mackenzie TSA	0	0	0	0	0	0.00	
	Dawson Creek TSA	405	405	405	405	405	540.00	218,70
	Ft. St. John TSA	1,000	1,000	1,000	1,000	1,000	285.00	285,00
	Fort Nelson TSA	250	200	200	200	200	0.5/tree	125,00
	Woodlots	208	150	150	150	150	518.36	107,81
	Total	2,622	3,145	2,650	2,545	2,545	380.52	997,71
Brushing		**1,337**	**1,285**	**1,200**	**1,150**	**1,150**	**718.05**	**960,04**
	Pr. Geo Supply Block	500	500	500	500	500	650.00	325,00

Vand. Supply Block	0	0	0	0	0	0.00	
Ft.St. Jms Supply Block	100	100	100	100	100	750.00	75,00
Robson TSA	40	85	50	50	50	1,000.00	40,00
Mackenzie TSA	0	0	0	0	0	0.00	
Dawson Creek TSA	0	0	0	0	0	0.00	
Ft. St. John TSA	0	0	0	0	0	0.00	
Fort Nelson TSA	200	200	250	200	200	580.00	116,00
Woodlots	497	400	300	300	300	812.96	404,04
Total	1,337	1,285	1,200	1,150	1,150	718.05	960,04
Totals hectares	34,367	30,275	22,994	17,763	17,640	115.61	3,973,26
Seed purchase	**2,491**	**2,945**	**2,500**	**2,395**	**2,395**	**463.37**	**1,154,25**
Pr. Geo. Supply Block	200	600	600	500	500	450.00	90,00
Vand. Supply Block	0	0	0	0	0	0.00	
Ft.St. Jms Supply Block	569	590	245	240	240	650.26	370,00
Robson TSA	40	150	50	50	50	306.25	12,25
Mackenzie TSA	0	0	0	0	0	0.00	
Dawson Creek TSA	405	405	405	405	405	523.00	212,00
Ft. St. John TSA	1,000	1,000	1,000	1,000	1,000	360.00	360,00
Fort Nelson TSA	250	200	200	200	200	400.00	100,00
Woodlots	27	0	0	0	0	370.37	10,00
Total	2,491	2,945	2,500	2,395	2,395	463.37	1,154,25
Prescriptions and planning dollars							**253,80**
Pr. Geo. Supply Block							200,00
Vand. Supply Block							
Ft.St. Jms Supply Block							
Robson TSA							18,30
Mackenzie TSA							
Dawson Creek TSA							3,00
Ft. St. John TSA							25,00
Fort Nelson TSA							7,50
Woodlots							
Total							253,80
Total backlog reforestation							5,381,31

Impeded areas

Surveys	**55,313**	**43,291**	**35,647**	**32,342**	**31,280**	**26.40**	**1,460,50**
Pr. Geo. Supply Block	15,000	10,000	5,000	4,000	4,000	25.00	375,00
Vand. Supply Block	7,400	2,611	1,367	1,062	300	30.00	222,00
Ft.St. Jms Supply Block	7,000	7,000	6,000	6,000	6,000	23.00	161,00

Robson TSA	3,000	2,100	1,800	1,000	700	25.00	75,00
Mackenzie TSA	1,833	1,000	900	200	200	30.01	55,00
Dawson Creek TSA	14,700	14,700	14,700	14,700	14,700	25.00	367,50
Ft. St. John TSA	2,880	2,880	2,880	2,880	2,880	26.04	75,00
Fort Nelson TSA	2,500	2,500	2,500	2,500	2,500	40.00	100,00
Woodlots	1,000	500	500	0	0	30.00	30,00
Total	55,313	43,291	35,647	32,342	31,280	26.40	1,460,50
Brushing	**13,629**	**12,699**	**11,770**	**9,251**	**9,283**	**676.40**	**9,218,70**
Pr. Geo. Supply Block	4,000	4,000	4,000	2,000	2,000	700.00	2,800,00
Vand. Supply Block	650	200	21	2	34	650.00	422,50
Ft.St. Jms Supply Block	2,530	2,150	1,500	1,000	1,000	750.00	1,897,50
Robson TSA	400	300	200	200	200	1,000.00	400,00
Mackenzie TSA	0	0	0	0	0	0.00	
Dawson Creek TSA	2,334	2,334	2,334	2,334	2,334	560.00	1,283,70
Ft. St. John TSA	1,815	1,815	1,815	1,815	1,815	650.14	1,180,00
Fort Nelson TSA	1,900	1,900	1,900	1,900	1,900	650.00	1,235,00
Woodlots	0	0	0		0	0.00	
Total	13,629	12,699	11,770	9,251	9,283	676.40	9,218,70
Density spacing	**550**	**427**	**150**	**150**	**150**	**663.63**	**365,00**
Pr. Geo. Supply Block	0	0	0	0	0	0.00	
Vand. Supply Block	400	277	0	0	0	650.00	260,00
Ft.St. Jms Supply Block	150	150	150	150	150	700.00	105,00
Robson TSA	0	0	0	0	0	0.00	
Mackenzie TSA	0	0	0	0	0	0.00	
Dawson Creek TSA	0	0	0	0	0	0.00	
Ft. St. John TSA	0	0	0	0	0	0.00	
Fort Nelson TSA	0	0	0	0	0	0.00	
Woodlots	0	0	0	0	0	0.00	
Total	550	427	150	150	150	663.63	365,00
Totals hectares	69,492	56,417	47,567	41,743	40,713	158.93	11,044,20
Prescriptions and planning dollars							**744,70**
Pr. Geo. Supply Block							200,00
Vand. Supply Block							
Ft.St. Jms Supply Block							145,00
Robson TSA							47,50
Mackenzie TSA							75,00
Dawson Creek TSA							220,50
Ft. St. John TSA							25,00
Fort Nelson TSA							31,70
Woodlots							

Total							744,70
Total impeded areas							11,788,90

Site Restoration

Fill planting	**30**	**30**	**30**	**30**	**30**	**449.88**	**13,50**
Pr. Geo. Supply Block	0	0	0	0	0	0.00	
Vand. Supply Block	0	0	0	0	0	0.00	
Ft.St. Jms Supply Block	0	0	0	0	0	0.00	
Robson TSA	30	30	30	30	30	450.00	13,50
Mackenzie TSA	0	0	0	0	0	0.00	
Dawson Creek TSA	0	0	0	0	0	0.00	
Ft. St. John TSA	0	0	0	0	0	0.00	
Fort Nelson TSA	0	0	0	0	0	0.00	
Woodlots	0	0	0	0	0	0.00	
Total	30	30	30	30	30	449.88	13,50
Rehabilitation	**280**	**280**	**280**	**280**	**280**	**683.91**	**191,50**
Pr. Geo. Supply Block	0	0	0	0	0	0.00	
Vand. Supply Block	0	0	0	0	0	0.00	
Ft.St. Jms Supply Block	0	0	0	0	0	0.00	
Robson TSA	30	30	30	30	30	550.00	16,50
Mackenzie TSA	0	0	0	0	0	0.00	
Dawson Creek TSA	0	0	0	0	0	0.00	
Ft. St. John TSA	0	0	0	0	0	0.00	
Fort Nelson TSA	250	250	250	250	250	700.00	175,00
Woodlots	0	0	0	0	0	0.00	
Total	280	280	280	280	280	683.91	191,50
Reforestation	**250**	**250**	**250**	**250**	**250**	**999.97**	**250,00**
Pr. Geo. Supply Block	0	0	0	0	0	0.00	
Vand. Supply Block	0	0	0	0	0	0.00	
Ft.St. Jms Supply Block	0	0	0	0	0	0.00	
Robson TSA	0	0	0	0	0	0.00	
Mackenzie TSA	0	0	0	0	0	0.00	
Dawson Creek TSA	0	0	0	0	0	0.00	
Ft. St. John TSA	0	0	0	0	0	0.00	
Fort Nelson TSA	250	250	250	250	250	1,000.00	250,00
Woodlots	0	0	0	0	0	0.00	
Total	250	250	250	250	250	999.97	250,00

Totals hectares	560	560	560	560	560	812.47	455,00
Seed purchase	**280**	**250**	**250**	**250**	**250**	**0.00**	
Pr. Geo. Supply Block	0	0	0	0	0	0.00	
Vand. Supply Block	0	0	0	0	0	0.00	
Ft.St. Jms Supply Block	0	0	0	0	0	0.00	
Robson TSA	30	0	0	0	0	280.00	8,40
Mackenzie TSA							
Dawson Creek TSA	0	0	0	0	0	0.00	
Ft. St. John TSA							
Fort Nelson TSA	250	250	250	250	250	0.40	200,00
Woodlots							
Total	280	250	250	250	250	0.00	
Prescriptions and planning dollars	**0**					**0.00**	**11,50**
Pr. Geo. Supply Block							
Vand. Supply Block							
Ft.St. Jms Supply Block							
Robson TSA							3,00
Mackenzie TSA							
Dawson Creek TSA	0					0.00	
Ft. St. John TSA							
Fort Nelson TSA							8,50
Woodlots							
Total	0	0	0	0	0	0.00	11,50
Total site restoration	840	810	810	810	810	555.33	466,50

Backlog Program Activities - Management Unit Total

Surveys	**89,130**	**73,242**	**60,619**	**52,176**	**47,790**	**27.67**	**2,466,48**
Site preparation	**2,871**	**2,405**	**2,405**	**2,405**	**2,405**	**605.00**	**1,736,97**
Planting	**3,787**	**4,020**	**3,455**	**3,370**	**3,370**	**478.92**	**1,813,68**
Brushing	**18,163**	**16,725**	**15,536**	**12,947**	**12,559**	**675.28**	**12,265,08**
Density spacing	**1,079**	**737**	**460**	**460**	**460**	**773.02**	**834,10**
Totals hectares	115,030	97,129	82,475	71,358	66,584	166.19	19,116,33
Seed purchase	**3,516**	**3,790**	**3,245**	**3,140**	**3,140**	**417.52**	**1,468,00**
Prescriptions and planning							**1,010,00**
Recommended studies							**260,00**
Pr. Geo. Supply Block							175,00
Vand. Supply Block							
Ft.St. Jms Supply Block							35,00
Robson TSA							
Mackenzie TSA							
Dawson Creek TSA							50,00
Ft. St. John TSA							
Fort Nelson TSA							

Woodlots	
Total	260,00
Total backlog program	**21,854,33**

2.2.3 FRBC REGIONAL PERFORMANCE TABLE

	Performance Measure	Tree Improvement	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
	Inputs											
A	**Planned treatment area (ha) in 2002/2003**	3,787	0	44,565	2,871	3,787	18,163	2,523	227	670	76,593	
1.0	**Timber Supply**											
1.1	Potential volume/ha gain (m3/ha/yr)	0.41	0	0	0	2.9	0.41	0.25	0	0.40		
1.2	Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3	Pot. total merch. volume increment in 65 years (m3)	100,924	0	0	0	723,699	484,044	40,999	0	17,420		1,367,086
1.4	Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4	Est. area that will be reclassified as stocked (ha)			11,140								11,140
1.5	Est. area that will be declared as free growing (ha)			89,113								89,113
2.0	**Wood Value**											
2.1	Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0	**Employment**											
3.1	Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	2	2.61	3.96	4.54	0.18	0.1	
3.2	Estimated total employment (person days/year)	379	0	4,457	2,727	7,574	47,405	9,991	1,031	121	7,659	
3.3	Estimated total full time equivalent positions (FTE)	2	0	25	15	42	263	56	6	1	43	452
4.1	**Forest Health Enhancement (ha)**											100
5.1	**Habitat Supply**											
5.2	Planned area for specific wildlife forage or habitat maintenance in 2002/2003 (ha)											0
5.3	Est. area with secondary value provided to biodiversity (ha)											0

2.2.4 REGIONAL SUSTAINABLE HARVEST PLAN SUMMARY

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	5,791	5,983	4,682	4,368	4,846	271	1,569,000
Planning, prescriptions and seedlings							107,500
Backlog Program Field Activities	115,030	0	0	0	0	166	19,116,330
Planning, prescriptions and seedlings							2,738,000
Totals	120,821	5,983	4,682	4,368	4,846		23,530,830

Performance Measures

Potential total merchentable volume increment in 65 years	1,367,086 m^3
Estimated ha that will be reclassified as stocked	11,140 ha
Estimated ha that will be declared as free growing	89,113 ha
Estimated total full time equivalent positions generated	452 FTEs
Forest health enhancement area	100 ha
Planned area for specific wildlife forage or habitat maintenance	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

2.3 PRINCE GEORGE TSA SUSTAINABLE HARVEST ISSUES AND SILVICULTURAL STRATEGY

This section describes the key sustainable harvest issues in the Prince George TSA, and defines a provisional silvicultural strategy to address them. The following strategic analysis is based on a recently completed Type I Silvicultural Analysis, but requires further, detailed forest analysis and modelling to validate and refine underlying assumptions. In the meantime, this strategy is reflected in the proposed, 5 year Sustainable Harvest Plans for each of the three forest districts making up the TSA. (Section 2.8).

2.3.1 THE RESOURCE LAND BASE

The Prince George TSA covers 7 512 789 hectares, of which 3 450 712 (46%) is considered to be in the timber harvesting land base, and is administered by the Prince George (1 429 558 hectares), Vanderhoof (777 028 hectares), and Fort St. James (1 244 126 hectares) Forest Districts.

Figure 2.1.1 shows age class distribution by leading species for the timber harvesting land base. The timber harvesting land base is comprised of 1.4% fir stands (51 730 hectares), 16.1% balsam stands (583 862 hectares), 33.0% spruce stands (1 193 796 hectares) and 49.4% pine stands (1789 350 hectares).

Approximately one-half of the timber harvesting land base consists of pine stands 121 years or older: and spruce, balsam and fir stands aged 141 years or older. As a consequence of species silvics and seral succession, stands older than 160 years tend to be dominated by spruce and balsam.

Spruce and pine dominates stands between the ages of 0 and 40 years, originating mainly from reforestation activities since 1970. A large proportion of the TSA is consists of pine dominated stands aged 40 to 160 years, most originating from large wildfires. These stands are expected to support future harvesting in the medium-term, as long as the scheduling of existing mature stands is planned to support harvesting until these younger stands reach operability.

Lodgepole pine dominates stands aged 41 to 160, with a smaller proportion of spruce. A majority of the stands older than 160 years are made up of spruce and subalpine fir.

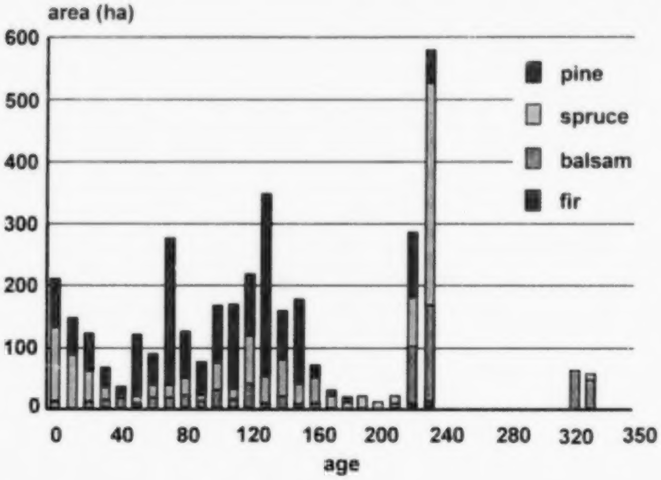

Figure 2.1.1 **Area by stand age and dominant tree species—timber harvesting land base, Prince George TSA 1995.**

Figure 2.1.2 illustrates the composition of the timber harvesting land base by supply block, tree species and site productivity. Pine stands occupying medium site classes make up the largest component of the TSA (26%). The Vanderhoof District contains the majority of the TSA's medium and poor pine stands (52.6%). The Prince George and Fort St. James Forest Districts contain virtually all of the good site pine stands (88.5%).

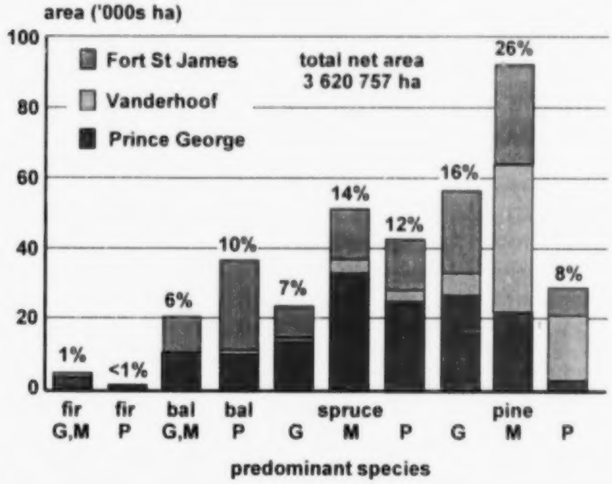

Figure 2.1.2 **Area by dominant tree species, site productivity and forest district– timber harvesting land base, Prince George TSA 1995.**

2.3.2 RESOURCE SUPPLY ISSUES

2.3.2.1 TIMBER SUPPLY – VOLUME

Limited Potential for AAC Increase - Currently there is no mid-term fiber supply shortfall forecast for the Prince George TSA. There are localized shortfalls, however, which have recently forced large-scale spatial shifts in industrial operations. There are also some indications that mid-term conditions for the TSA as a whole will limit early capture of the potential long term benefits that are yet to be calculated based on OGSI adjustments and genetic gain. Silvicultural strategies to address this issue must either move stands up in the harvest queue or increase volumes in stands that are likely to be harvested in the mid-term period. Either strategy will increase harvest flexibility in the mid-term by increasing the volume of timber that is available for harvest.

Lodgepole Pine Height Growth Repression - Density related repression of lodgepole pine is known to be commonplace in the Prince George TSA, and reduces pine volume production by slowing stand development. Currently it is difficult to determine the degree of repression inherent in the existing forest cover. Stands with light and moderate levels of repression are still included in the THLB, but projected volume production is well below site potential (a reduction in apparent SI50 from 20 to 15 will result in roughly a 50% loss in MAI). Stands with high levels of repression may be excluded from the THLB due to a low apparent site index, even though potential SI50 may be 18 or more.

Backlog Status - The future supply of timber may be impacted where the TSR assumptions regarding backlog stocking status may be out of step with actual stand conditions. Treatment of backlog stands is viewed as a mandatory program, and assumptions for completion have already been included in TSR. For the most part there will be no timber supply gains per se; the benefits will be in maintaining the conditions that are already assumed. To a small degree, however, there may be some timber supply benefits in accelerating the backlog program over the TSR assumptions; earlier treatment will result in earlier availability for harvest. There may also be small gains through improvement of stocking conditions beyond those assumed.

Stocking Standards and Yield - Existing stocking targets for both current and backlog reforestation may impact timber supply. Recently increased stocking levels may increase harvest volumes and decrease culmination ages. For example, theoretical analyses suggest that increasing free growing stocking targets from 1200 to 1800 trees/ha for a lodgepole pine stand of SI50=20, would result in an 0.4 m^3/ha/yr (8%) increase in CMAI, and a decrease of 8 years in MAI culmination. Theoretical benefits would include increased harvest flexibility and a higher LTHL.

Vegetation Management Requirements - The TSR assumes that existing regenerated stands are unimpeded, an assumption which may be optimistic. This issue must be addressed via an aggressive brushing and spacing program.

Forest Pest Losses - Forest health issues affect either the volume of existing mature stands in the TSA (Mountain Pine beetle, Douglas fir bark beetle, spruce beetle, Balsam bark beetle, spruce budworm), or the volume production of regenerated stands (Spruce (White Pine) Leader Weevil, Lodgepole Pine gall rust, Commandra blister rust. An epidemic level of bark beetle infestation is prevalent in the Fort St. James and Vanderhoof supply blocks largely due to the age class distribution of the forest. For example, approximately 70% of the Fort St. James Forest District (2.7 million hectares) is comprised of mature and over-mature timber, highly susceptible to pest damage. While the extent of infestation is not known with any precision, a conservative estimate for Fort St. James is close to 1 million ha.

The impact of the forest health issue on harvest activity is reflected in the Vanderhoof Supply Block. It is estimated that up to 80-90% of the 2001annual harvest will come from salvage cutting of Mountain pine beetle and spruce beetle infestation areas. This represents a doubling of salvage harvest since 1999.

2.3.2.2 TIMBER SUPPLY - QUALITY

The premium timber product throughout much of the TSA remains as sawlog quality spruce and pine with diameters greater than 40 cm and heights between 22 and 35 metres. Log quality and size will continue to decline as younger stands are selected for harvesting, yet tactical options to improve timber quality in the Prince George TSA are limited to stand density management manipulation (plantation stocking density and precommercial thinning) and tree branch pruning.

For example, current sawmill configuration in the Vanderhoof Supply Block require sawlogs with a mean diameter at breast height (DBH) of 22 cm, and average relative density at breast height of 0.41 g/cm. Cost effective harvesting requires operable stand volumes of approximately 300 m^3. These timber product specifications can be achievied in second growth stands by maintaining stands at sufficient densities to satisfy the operability requirements, as well as encouraging natural, early crown lift, thereby minimizing the amount and proportion of juvenile wood production, and maintaining optimum tree and log characteristics.

While stem pruning offers a second option, it is practical only as a specialty timber production tactic. Pruning investments remain questionable for the TSA due to uncertain future timber markets and consequent poor stand level investment return. Pruning may be considered as a strategic investment at such time when these uncertainties have been resolved.

Tree branch pruning may be a more viable tactic for minimizing the stand production losses associated with lodgepole pine stem rust infections. As a forest health activity, the pruning-removal of lethal branch infections could have a beneficial impact on stand production. Treatment may prevent rust infected areas classified as SR from becoming classified as NSR. This may be a more cost effective alternative to stand rehabilitation and re-establishment.

2.3.2.3 HABITAT SUPPLY

Prince George Supply Block Issues

- ungulate winter range – upland sites
- overall forage supply – upland sites
- riparian cover and protection - streams and wetlands
- homogeneous stand structure

Fort St. James Supply Block Issues

- stand dynamics and the future supply of specific habitat types (lichen production,
- impact of fire control on the supply of specific habitat, such as grasslands

Vanderhoof Supply Block Issues

- Managed stand structure and habitat quality/use by large mammals (deer, moose and bear).

2.3.2.4 EMPLOYMENT ISSUES

In the Prince George Supply Block, a large portion of the stand tending program is implemented using labour intensive. manual methods. A shift to a higher proportion of herbicide treatments is necessary to ensure better efficacy of treatment, and to allow for higher timber supply gains with a fixed or reduced budget.

In the Fort St. James Supply Block job outcomes are dependent on licensee activities. The district should maintain ample opportunities for local contractors through the competitive bid process. In addition, licensees have either First Nation partners or hire contractors who employ aboriginal people.

Much of the planned work is seasonal, but pre-commercial thinning can be done during winter months. This extends the traditional work window right through to spring if there is not an unusually heavy snowfall, giving some stability to that group of workers.

2.3.3 SILVICULTURAL PRACTICES

2.3.3.1 INCREMENTAL SILVICULTURE HISTORY

Table 2.1.1 documents the incremental silviculture activities for the Prince George Supply Block since 1990. Tables 2.1.2 and 3, document precommercial thinning, fertilization and pruning activities for the Fort St. James Supply Block since 1980. Table 2.1.4 documents the incremental silviculture activities of the Vanderhoof Supply Block since 1995.

Table 2.1.1 Incremental Silviculture history 1990-99 , Prince George supply block.

Year	Silviculturally Treated Area (ha)							
	Surveys	Brushing	Site Preparation	Planting	Juvenile Spacing	Fertilization	Pruning (first lift)	Audit
1990	51332		6331	15940	439			
1991	54425	6349	5456	10258	847		21	
1992	52858	8104	4211	6293	860		6	16
1993	41827	6343	2422	5429	1275	4	20	
1994	50773	5542	1016	3057	896		104	6
1995	48189	4168	779	3472	1462	0.3	2	
1996	30282	4162	44	1587	1009		154	
1997	45555	2046	575	1187	2123	286		
1998	32036	2511	445	367	2467		84	
1999	5547	29	7	224	142			
Total	**412823**	**39254**	**21286**	**47813**	**'520**	**291**	**391**	**22**

Table 2.1.2 Incremental silviculture history 1980-89 , Fort St. James Forest District.

	Silviculturally Treated Area (ha)	
Year	Fertilization	Juvenile spacing
1980		19
1981		60
1982		39
1986		122
1987		467
1988	325	273
1989	272	430
Total	**597**	**1410**

Table 2.1.3 Incremental silviculture history 1990-98 , Fort St. James Supply Block

	Silviculturally Treated Area (ha)		
Year	**Fertilization**	**Juvenile spacing**	**Pruning Single Lift**
1990		634	
1991		1338	186
1992	713	1343	16
1993		1284	317
1994	528	1052	174
1995		454	124
1996		819	272
1997		850	97
1998	125	445	116
Total	**1366**	**8218**	**1302**

Table 2.1.4 Incremental silviculture history 1995-2000 – Vanderhoof Supply Block

	Silviculturally Treated Area (ha)			
Year	Juvenile Spacing	Fertilization	Pruning	Surveys
1995	1359.2	0.0	59.2	962.3
1996	1818.9	571.4	652.3	9079.3
1997	2243.6	823.7	69.8	4649.5
1998	2478.0	13.6	445.0	5679.7
1999	2029.3	342.6	330.2	3167.9
2000	967.9	0.0	0.0	1612.7

2.3.3.2 BACKLOG SILVICULTURE

Conventional restocking (site preparation, planting/fill planting) and crop enhancements (brushing and weeding/conifer release) are employed in the TSA to address backlog NSR and impeded stands.

Prince George Supply Block

The Prince George Forest District has approximately 18 000 hectares of Backlog NSR. Of this area, approximately 75% may be reclassifiable to a stocked condition. These stands are generally old "intermediate utilization" blocks so the residual timber volumes they support are undoubtably marginal. Treatable NSR sites are a high priority as well as stand improvement treatments of backlog plantations, both of which require extensive silvicultural surveys and prescription preparation.

Current information indicates there is approximately 18,000 hectares of backlog NSR within the District. Approximately 350,000 hectares of pre-1987 harvested area has been reforested in this supply block.

Fort St. James Supply Block

There are approximately 2 500 of backlog NSR in the supply block, including 500 ha within the Pierre Forest. Silvicultural surveys are required to develop prescriptions for treatments needed to reach free growing or reclassify sites as non-productive. The aim is to eliminate NSR areas by 2005/2006. All treated stands are expected to reach a free growing state by the year 2020. There is an increasing trend to manually treat impeded stands rather than rely on herbicides in this supply block due to on-going protests over the use of forest herbicides by First Nations groups.

The status of the Pierre Forest portion of backlog NSR is unique to this supply block. The Pierre Forest was originally logged in the late1950's to early 1960's. It was part of Tree Farm Licence (TFL) 42, which was awarded in the early 1980's. As part of the agreement, reforestation for this tree farm licence remained as Ministry of Forest responsibility. In the late 1980's to early 1990's rehabilitation and planting was carried out by the Forest Service, and the need for followup brushing treatments was anticipated since these sites were considered difficult to reforest. First Nations managers of the TFL were fundamentally opposed to the use of herbicides, yet manual brushing treatments were not considered an cost effective nor reasonable alternative by the Forest Service. Despite these circumstances, it was decided at that time (early 1990's) that the TFL Licencee's management plan obligations would be limited to manual treatment of the area.

Surveys from 1999 on the entire Pierre Forest indicate that 47%of the area is now NSR; 46% is SR and in need of brushing; 1% is FG; and 6% is in permanent access or non-productive state. In view of the state of reforestation, and the inability of the licensee to implement remedial measures, senior Forest Service managers have allowed the licensee to include portions of the Pierre Forest in the area eligible for Forest Renewal British Columbia (FRBC) treatments as pre 1987 backlog. Each site must be approved, by the Ministry of Forests, based on good forest stewardship and the cost effectiveness of the treatment.

Vanderhoof Supply Block

Surveys, prescription development and brushing are the highest priority backlog silviculture tactics in the supply block. All backlog impeded stands are expected to reach free growing status by 2010. The anticipated scale surveys will decline after 2001, and the scale of brushing required to meet the free growing objective will be relatively small compared to the other supply blocks.

Reforestation is a moderate priority, recognizing the expected scale of higher priority issues. All backlog NSR sites are expected to be restocked by the year 2002.

2.3.3.3 PRECOMMERCIAL THINNING

Prince George Supply Block

FRDA and social forestry programs have provided funding over the past 20 years for precommecial thinning (juvenile spacing). Most treatment opportunities in overstocked, high priority stands of natural regeneration origin have been addressed during the past two decades. Future precommercial thinning/cleaning will be focused on pre-1987 plantations. It is expected that approximately 5000 hectares per year of this treatment may be required. Tactical options will includemotor-manual brushing, girdling as well as chemical treatments.

Typically, lodgepole pine stands of establishment densities ranging from 10 000 to 15 000 sph are targetted for precommercial thinning. Precommercial thinning prescriptions call for treatment at stand age 12 to 18 years, and target a residual stand density of 2 000 sph.

Fort St James Supply Block

Precommercial thinning of 21 to 40 year old plantations is expected to accelerate in this supply block. Precommercial thinning regimes are locally variable in the Fort St. James Supply Block. Post treatment spacing is prescribed on the basis of forest health and site occupancy. Where lethal stem rust infections or other pest problems occur, target stand densities are generally 1800 stems/ha.

Stand Management Prescriptions for precommercial thinning in 50 + year old fire origin pine stands generally prescribe 1600 to 1800 sph. An additional requirement ensures that a minimum of 20 m2 of residual basal area is retained in the stand. The opportunity treatment area is not currently known, nor is the scale of treatment required to address timber supply issues.

Vanderhoof Supply Block

In the Vanderhoof Supply Block the highest priority for precommercial thinning are stands currently in excess of 10 000 sph (maximum density spacing). Stands of densities between 5000 to 10,000 sph are a lower priority for treatment. Stands less than 5,000 stems per hectare are generally not treated. Residual stand densities are designed to yield the sawlog characteristics described in Section 2.1.2.2.

2.3.3.4 TREE IMPROVEMENT

Genetic gain has not been incorporated in the TSR2 base case for the Prince George TSA. The projected gain from improved seed is presented in Table 2.1.5.

Table 2.1.5 Forecast gain in volume from improved seed for the Prince George Region.

TSA	Species & Seed Zone	Elevation (m)	Gain from Improved Seed (%)		
			98-99	99-00	2007-08
Prince George TSA					
	Pli PG low	<1100	6	6	7
	Pli BV low	<1100	7	7	9
	Sx PG low	<1200	14	15	17
	Sx PG high	<1200	17	17	16
	Sx BV low	<1200	2	3	12
	Fdi PG all	<1100	19	19	19

Source: Forest Genetics Council of BC.

2.3.4 TSR 1 MANAGEMENT ASSUMPTIONS

In addition to the inventory, or current state of the forest, assumptions about how it will be managed as are essential for determining a silviculture strategy for the TSA.

2.3.4.1 INVENTORY PROFILE

The species profile for the Prince George TSA is, like most subboreal management units, expected to change under the management regimes projected in the TSR 1 base case. Spruce is expected to displace subalpine fir, and Lodgepole pine will likely increase in proportion to spruce.

In the Fort St. James Supply Block, lodgepole pine has, in the past, been considered the most desirable species on appropriate sites because of shorter rotations. Many areas of harvested Douglas-fir have been re-established as pure pine stands. As a result of LRMP and forest health issues this practice is expected to change. An objective of the Fort St. James Land and Resource Management Plan is to maintain or expand the range of Douglas-fir. Further, forest health problems with pine may be partially offset by establishing mixed stands. The proportion of lodgepole pine in the inventory is therefore expected to decline slightly over the medium term, while spruce and Douglas-fir components will increase.

2.3.4.2 MANAGEMENT ZONES AND FOREST COVER REQUIREMENTS

The TSR management zones and their associated forest cover requirements are listed in Table 2.1.6 and the minimum harvest ages are summarized in Table 2.1.7.

Table 2.1.6 Management zones and forest cover requirements.

Management Zone	Maximum Allowable Disturbance (% area)	Green-up height (metres)	Minimum retained area (%)	Minimum age for retention (years)
VQO - retention	4	5	N/A	
VQO – partial retention	11	5	N/A	
VQO - modification	21	5	N/A	
VQO – maximum modification	33	5	N/A	
Vanderhoof LRMP - special	20	3	N/A	
Caribou – medium (Prince George Forest District)	33	3	33	80
Caribou – corridors (Prince George Forest District)	20	3	20	100
Aleeza Lake Research Forest	25	3	25	110
Herrick FENS	25	3	25	120
Other integrated management areas	25	3	N/A	

Source: TSR Prince George Data Package 1998, p39.

Table 2.1.7 Minimum harvestable ages by leading species.

Species	Minimum Harvestable Age (years)
Spruce	>101
Pine	>81
Fir	>111
Balsam	>121
Cedar	>111
Hemlock	>111
Deciduous	>61

Source: TSR Prince George Data Package 1998, p30.

2.3.4.3 HARVESTING PRACTICES

Table 2.1.8 indicates the approximate apportionment of the annual harvest within the three supply blocks of the TSA. There is considerable variation, year-to-year in these proportions, largely driven by forest level dynamics caused by fire and pests and local economy.

Table 2.1.8 Harvest apportionment in the Prince George TSA[1]

Supply Block	Current Harvest Area (ha)	Current Harvest Volume (m^3)
Prince George	16 000	4 500 000
Vanderhoof	7 000	1, 930,000[2]
Fort St. James	12 000	3 200 000[3]
Total	35 000	9 630 000

2.3.5 TIMBER SUPPLY DYNAMICS AND THE AAC

The 1995 TSR shows an even-flow harvest level which can be maintained throughout the entire planning horizon (Figure 2.1.3). The base case harvest forecast level is 9 630 000 m^3 per year. This level is 3% above the current AAC of 9 363 661 m^3 per year resulting from the 1996 Rationale for AAC Determination. The base case harvest forecast is the maximum non-declining harvest level that can be achieved without resulting in future shortfalls.

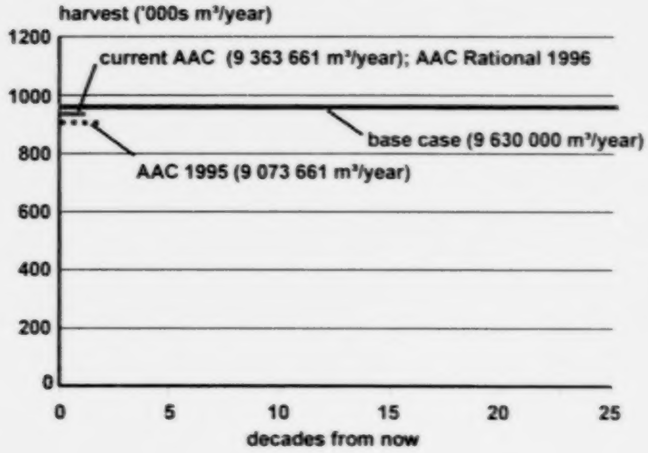

Figure 2.1.3 Base harvest forecast, Prince George TSA.

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[1] Figures are approximate only; cut is shifted throughout the TSA in response to pest and salvage priorities.

[2] Includes a non-renewable license to cut small pine (L&M Lumber Co. Ltd.) of 290 770 m^3.

[3] Currently undercut due to mill shutdowns in 1999.

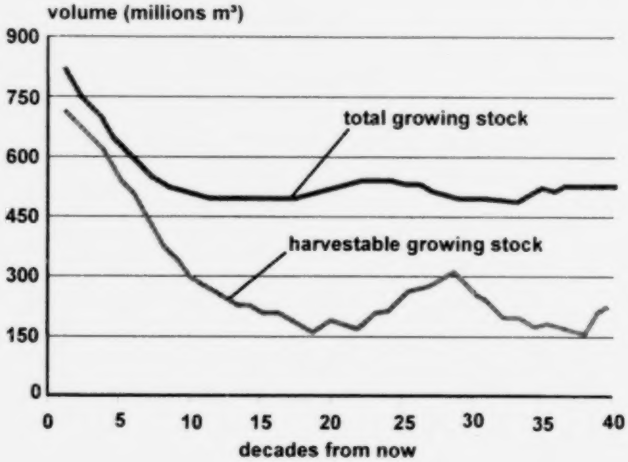

Figure 2.1.4 **Changes in growing stock over time, Prince George TSA.**

Figure 2.1.4 illustrates that the total growing stock for the base case harvest level can maintained at a constant level from year 100 to the end of the planning horizon. This demonstrates that the harvest level is near the productivity level of the timber harvesting land base.

2.3.6 KEY ISSUES AND POTENTIAL SILVICULTURAL STRATEGIES

This section identifies the key Sustainable Harvest issues facing the TSA, as well as potential silvicultural strategies suitable for addressing them. Of those resource supply issues described in Section 2.1.[illegible], five are considered key by management unit stakeholders:

- Potential mid-term timber supply gaps.
- Reduced productivity of backlog stands in the timber supply landbase.
- Lodgepole pine managed stand pest losses.
- Repression-related productivity losses of existing pine stands.
- Potential decline in the quality of the timber supply.

Tables 2.1.8 and 2.1.9 identify the issues that could be addressed through specific silvicultural strategies, targetted stand types, recommended silvicultural tactic(s), potential annual levels of investment, potential benefits and overall TSA investment priority. Actual investment priorities recommended for each Forest District within the Prince George TSA (Section 2.7) vary, depending on the district-specific nature of many of the issues. In all cases, local technical expertise, current policies and present uncertainties surrounding some potential strategies are reflected in SH investment recommendations.

Issues that were identified as requiring investigation prior to silvicultural action are discussed in Section 2.1.10.

2.3.6.1 ISSUE 1: POTENTIAL GAPS IN MID-TERM TIMBER SUPPLY

Strategy 1: Move Existing Stands Ahead in Harvest Queue.

TACTIC 1 THIN AND FERTILIZE MODERATELY REPRESSED 40-70 YR-OLD PINE STANDS (CURRENTLY IN THE THLB)

Target Stands:

Moderately repressed 40-70 yr pine stands (currently in THLB).

Expected Forest Level Benefits:

The full potential for this treatment is not yet known. Conservative estimates for thinning alone, which is currently being carried out on a limited basis in the Fort St. James Supply Block, are that stands will be available for harvest two decades earlier than with no treatment. A thinning program of 200 ha/yr for the next 10 years would provide 2000 ha for harvest in the mid-term that would not otherwise be available.

A study is recommended to investigate the effects on fertilizing these stands (or applying multiple fertilizer treatments alone). If the stands show a standard fertilizer response, there is the potential for an extra 10-15 m^3/ha for each fertilizer application. If, in addition to the expected fertilizer response there is an added effect of partially or complete reversing overcome density related repression as has been observed in some younger stands, the benefits could be much greater.

TACTIC 2 PRECOMMERCIAL THIN PREPARATION FOR FUTURE COMMERCIAL THINNING

Subject to the known biological limitations of stand density management theory, some reduction in the age of operability, and improvement in commercial thinning economics can be gained by precommercial thinning to a residual density which permits intermediate entries. Caution, and careful analysis is advised in the implementation of this tactic.

Strategy 2: Increase Volume Yields of Existing Stands

TACTIC 1 FERTILIZE THRIFTY JUVENILE STANDS ON 10-YEAR CYCLE

Fertilizing stands currently 20-40 years old on a repeat cycle of 10 years will make these stands available for harvest sooner. Target stands include spruce and pine stands on medium and good sites. Assuming a conservative volume gain of 10 m^3/ha for each treatment, an average MAI of 4 m^3/ha/yr, and four fertilizer treatments, stands will be ready for harvest with the same volumes 10 years earlier than without treatment.

Table 2.1.8 Possible silvicultural strategies to mitigate key Prince George TSA issues

Key Issue	Issue Description	Objective	Silvicultural Strategy	Silvicultural Tactics	Target Stands	Rank
Mid-term gap in fibre supply	Localized shortfalls are forcing large scale spatial shifts in industrial operations	Make more timber volume available in mid-term.	Move Stands up in Harvest Queue (increase operability)	Thinning Fertilization	moderately repressed 40-70 yr pine stands (currently in THLB)	11
				PCT preparatory to CT	15-20 yr old Pl on medium and good sites	5
			Increase Volume Yields	Fertilize on 10-yr cycle	20-40 yr old thrifty Sx, Pl in PG supply block, on medium and good sites	10
				Fertilize on 10-yr cycle	40-60 yr old thriftySx and Pl pole size stands in PG supply block on medium and good sites	10
				Survey IU Stands Reclassify/Harvest IU Stands	old Intermediate Utilization (IU) harvest units	3 4
Productivity of Backlog stands	Treatment of backlog is mandatory and already assumed in TSR--a "must do" for the District.	Eliminate existing backlog NSR and maximize yields.	Maintain Productivity ofTHLB Land Base	Survey and reclassify	Areas labelled backlog NSR	1
				Site preparation Planting brushing	Areas surveyed and classed backlog NSR	2
				Brush/space	Backlog impeded stands in PG supply block	1
				Brush/space	Backlog impeded stands in Vand. supply block	2
				Brush, space	Backlog impeded areas in FSJ supply block	2
				site prep, plant under canopy or in voids	Backlog stands supporting aspen stands	8
				Site prep plant IU	old Intermediate Utilization (IU) harvest units	8
Managed Stand Pest Losses	Losses to Western gall rust	Reduce losses from Western gall rust	Minimize Stocking Losses due to Infections	Prune infected branches	pre-87 SR pine in FSJ and V and Supply blocks	7
				Monitor/Map risk due to forest health hazards	All managed stands	6
Repression Losses	Density-related repression may reduce stand productivity so that stands are netted out of the THLB	Reduce, reverse, or eliminate effects of repression on existing stands	Increase THLB/increase yields by treating repressed Pli stands to make them operable/replacing them with normal stands	Survey	30 - 40 yr old fire origin, overstocked pine	5
				Reclassify, bring into THLB, early harvest		5
				Rehabilitate and plant		5
				Thin, fertilize		5
Maintaining Timber Quality	Clear lumber is about 3 or 4 times greater than similar wood containing knots	Diversify log products from TSA by producing small amounts of clear lumber	Clearwood pruning	Branch pruning, single lift	Pine on highest sites in TSA (24 m +)	12

Table 2.1.9 Key issues, silvicultural strategies and tactics, and their potential impact on resource supply in the Prince George TSA.

			Opportunity	Timber Supply Effects				Habitat	Jobs	Cost	Priority
Key Issues	Silvicultural Strategies	Silvicultural Tactics	Area (ha/yr)	Short 0-20	Medium 21-120	Long 121+	Quality		Days/ha	$/ha[1]	Rank
Mid-term gap in fibre supply	Moves Stands up in Harvest Queue	PCT and/or fertilizing (moderately repressed Pl)	200		+	+	+	+	3.0	562	11
		IU Stand Surveys	5 000						0.05	32	5
		IU Stand Reclassification and harvesting	3 200		++++			-			3
		Pre-commercial thinning (PCT)	2 400						3.0	562	4
		Fertilizing thrifty juvenile stands	300		++	+	+	+/-	0.1	443	10
		Fertilizing thrifty pole-size stands	300						0.1	443	10
Productivity of Backlog Stands	Maintain Productivity of THLB	Surveying and reclassifying	66 000		M	M			0.05	32	1
		Site preparation, planting, brushing	1 800		M	M			4.5	2 027	2
		Brushing, spacing (Dpg)	9 000		M	M		+/-	5.0	1 100	1
		Site preparation, fill planting (aspen)	150			+			2.5	1 450	8
		Site preparation, fill planting (old Intermediate Utilization blocks)	150			+			2.5	1 450	8
Managed Stand Pest Losses	Minimize Stocking Losses	Pruning infected branches	150		M				4.0	1 188	7
		Rust Monitoring	TSA		M	M					6
Pine Repress.	Incr. THLB/Yield	Surveying	1 500						0.05	20	5
		Reclassifying	1 200		++	++		+			5
		Rehabilitating and planting	500		++	++		+	2.5	1 300	5
		Thinning, fertilizing	300		++	++	+	+	3.0	500	5
Timber Quality	Clear Wood Pruning	Pruning	170				++	-	4.0	1 188	12

A program which initiates this treatment regime on 300 ha/yr over the next 10 years would provide 3 000 ha that is available for harvest one decade sooner than without treatment.

TACTIC 2 FERTILIZE THRIFTY POLE-SIZED STANDS ON 10-YEAR CYCLE

Fertilizing stands currently 40-60 years old on a repeat cycle of 10 years will provide additional volume when these stands are harvested in the mid-term. This will provide increased flexibility in harvest scheduling of the rationed old growth. Assuming a conservative gain of 10 m^3/ha for each treatment and four treatments, each hectare treated will provide an extra 40 m^3. A program which initiates this treatment regime on 300 ha/yr over the next 10 years is expected to result in an extra 120 000 m^3 of available volume during the mid-term.

TACTIC 3 SURVEY/RECLASSIFY/SCHEDULE FOR SALVAGE HARVEST OLD INTERMEDIATE UTILIZATION (IU) HARVEST UNITS

Target Stands:

Residual stands resulting from 30 –40 year old intermediate utilization harvesting.

Expected Forest Level Benefits

Many areas harvested either to intermediate utilization standards (circa 1963-1970) and those harvested earlier under a variety of partial cutting regimes have uncertain stocking and rates of growth. Some are growing well, are not adequately recognized in the inventory, and will be available for harvest in the mid-term. Others which are growing poorly still have sufficient volume for harvest either now or in the mid-term; harvesting these stands provides greater flexibility in harvesting the rationed old growth.

Benefits of this tactic include increases to the THLB (where stands are either misclassified as having a low site index or have insufficient stocking to produce minimally harvestable volume), increases in MAI through accelerated conversion to more productive stands, and increased harvest flexibility in the mid-term. There are approximately 25 000 ha of old harvesting units remaining in this category, approximately 16 000 of which can be dealt with through re-classification.

2.3.6.2 ISSUE 2: REDUCED PRODUCTIVITY OF BACKLOG STANDS IN THE THLB

Strategy 2: Maintain the Productivity of the Timber Harvesting Land Base

TACTIC 1 BACKLOG SURVEYS/RECLASSIFICATION

and

TACTIC 2 BACKLOG SITE PREPARATION/PLANTING/BRUSHING

Target Stands:

Areas labelled backlog NSR

Expected Forest Level Benefit:

A program of 66,000 ha per year of surveys will facilitate reclassification of existing backlog NSR, and support planning for necessary silvicultural improvement treatments.

A program to initiate a site prep/plant/brush sequence is required at a rate of 1800 ha/yr. This rate is faster than that currently assumed in TSR and may increase harvesting flexibility in the late mid-term and early long term.

TACTIC 3 ENHANCEMENT OF BACKLOG ASPEN STANDS

Target Stands:

Backlog stands supporting aspen stands

Expected Forest Level Benefits:

Backlog stands that have regenerated to aspen and have been accepted as aspen stands at least for the current rotation can be enhanced for volume production either by under-planting with spruce or by planting spruce in canopy voids. In both situations, the successive conifer rotation will be shortened by 10-30 years due to the use of an already-established crop. A program of 150 ha/yr is thought to be possible.

TACTIC 4 ENHANCEMENT OF YIELD ON IU RESIDUAL STANDS

Target Stands:

Residual IU stands with inadequate stocking or potential yield.

Expected Forest Level Effect

Some IU residual stands poorly stocked (insufficient trees of an ecologically suitable species) and require restocking. Treatment. This will both increase the productivity of the stand and increase stand operability. These stands should be scheduled for prompt treatment such as fill planting or underplanting. This could potentially improve stand volume yields in the medium term. A program of 150 ha/yr is recommended.

TACTIC 5 BACKLOG IMPEDED BRUSHING

Target Stands:

Backlog impeded stands throughout the TSA.

Expected Forest Level Benefits:

A program of 9 200 ha/yr of brushing and spacing (pre-commercial thinning) is required (5 000 ha/ yr in Prince George, 2000 ha/yr in Vanderhoof and 2 200 ha/yr in Ft. St. James Supply Blocks).These treatments will ensure that currently established stands are meeting the expectations already assumed in TSR.

2.3.6.3 ISSUE 3: LODGEPOLE PINE MANAGED STAND PEST LOSSES

Strategy 1: Reduce Stocking Loss Impact of Rust Infected Pine Stands

Strategies to protect forest health are intended to maintain conditions favorable for maximizing timber production. Avoiding pest problems will help maintain productivity levels already assumed in TSR, thus no gains per se are expected.

TACTIC 1 INFECTED BRANCH PRUNING

Stands heavily infected with western gall rust can be treated to reduce impacts of branch infections that will eventually be engulfed in the bole of the tree. Such infections reduce lumber yield and can cause tree mortality. Pruning infected branches will reduce losses. A program of treating 150 ha/yr is thought possible, primarily in Fort St. James and Vanderhoof Supply Blocks.

Strategy 2: Pest Distribution Prediction and Decision Support

TACTIC 1 FOREST HEALTH HAZARD MAPPING

A project to enhance current efforts in mapping forest health hazards is needed to improve both silvicultural planning specifically and forest management planning generally. This is a risk management function needed to help both direct and protect forest investments.

2.3.6.4 ISSUE 5: REPRESSION LOSSES IN EXISTING PINE STANDS

Strategy 1: Reduce/reverse/eliminate Repression in Existing Stands

TACTIC 1 REPRESSED STAND SURVEYS

and

TACTIC 2 RECLASSIFICATION

and

TACTIC 3 THINNING AND FERTILIZATION

and

TACTIC 4 STAND REPLACEMENT

Target Stands:

30 - 40 yr old fire origin, overstocked Lodgepole pine stands throughout the TSA.

Expected Forest Level Benefits:

Density related repression of lodgepole pine reduces volume production by dramatically slowing stand development. Stands with light and moderate levels of repression are still included in the THLB, but projected volume production is well below site potential (a reduction in apparent SI50 from 20 to 15 will result in roughly a 50% loss in MAI). Stands with high levels of repression may be excluded from the THLB due to a low apparent site index, even though potential SI50 may be 18 or more.

Approximately 500 ha/yr of 30-40 year old, fire origin pine stands should be surveyed in the Prince George Supply Block, in order to provide a basis for deciding whether retain the stand, or rehabilitate and reforest. It was estimated that approximately 300 ha of each 500 surveyed would be left and scheduled for an early harvest as pulpwood. The benefits of this treatment would be an immediate increase in the THLB through rehab treatments (approx, 200 ha/yr for 10 years) with a further 3 000 ha being returned to the THLB as pulpwood stands are harvested over a time horizon of 10 to 50 years. Volume harvested as pulpwood from these stands (80-120 m^3/ha) would increase harvest flexibility in the rationed old growth.

In the Vanderhoof Supply Block approximately 1 500 ha/yr of 30-40 year-old fire origin pine stands should be surveyed. Of this, it is estimated that 900 ha/yr will be reclassified as productive, while 300 ha/yr will be thinned and fertilized, and 300 ha/yr will be rehabilitated and reforested. All areas will be returned to the THLB either through reclassification or stand improvement.

There is a sustantially larger inventory of similar stands in the Fort St. James Supply Block. Similar treatment decisions are expected. A pilot program of precommercial thinning over the next 5 years combined with fertilizer treatments in the thinned stands is suggested to improve harvest flexibility in the mid-term. Volumes removed from these stands during possible commercial thinning in the short term future would improve options for rationing old growth. Subsequent refertilization following CT could partially partially replace CT volume removals.

2.3.6.5 ISSUE 6: DECLINING QUALITY OF TIMBER SUPPLY

Strategy 1: Prune to Produce Clear Lumber

TACTIC 1 CLEAR WOOD PRUNING

target Stands"

Superior Lodgepole pine stands of the highest site productivity potential in the TSA (> 24 m @ 50 years)

Expected Forest Level Benefits:

Clear lumber is commonly valued 3-4 times greater than similar wood containing knots. Trees pruned to produce clear lumber have the potential then to yield higher stumpage values than non-pruned trees (although regimes to prune trees in interior BC stands are typically financially non-viable or highly risky). Expected benefits from a conservative pruning program include short term employment and future product diversification. A program of 170 ha/yr is suggested, to be directed to the 5% top productivity lodgepole pine sites (>24 m @ 50 years), and most biologically responsive stands.

2.3.6.6 RECOMMENDED KNOWLEDGE STRATEGIES

There are many related TSA silvicultural issues which are not directly addressable via silvicultural practices. Many of these require investigation and further study. Table 2.1.9 identifies, and ranks the importance of 12 Sustainable Harvest knowledge gap issues. The reader is directed to Volume 4 of this RMP, dealing with comprehensive SSFM knowledge strategies and tactics. Most of the issues in Table 2.1.9 have been incorporated into this SSFM analysis.

Table 2.1.9 Silvicultural issues requiring study.

Sustainable Harvest Knowledge Gap Issue	Priority
OAF study for plantations There is concern regarding the use of Provincial default OAF 1 values for TSR yield determinations using TIPSY for managed stands. A sampling strategy is required to obtain locally accurate OAF 1 estimates. This will serve a dual purpose: a) it will provide better estimates of local managed stand yields for use in TSR, potentially stratified by stand type, ecosystem unit or year of stand origin (i.e. pre 1983, 1983 to 1987, post 1987). b) it has the potential to affect reforestation practices (current and backlog sites) by highlighting areas of concern related to stocking and associated yield impacts.	1
Growth and yield of managed stands for pure and mixed stands A program is needed to establish permanent sample plots for growth and yield in managed stands. No such program currently exists. Data sets are required to monitor growth in pure and mixed species/complex stands at stocking levels similar to those currently being established in managed stands – such stands are rare in the existing data sets predominated by natural stands. This data is necessary for calibration/validation of models such as Prognosis^{BC} and MGM.	1

Improved SI estimates for disturbed sites There is concern regarding the accuracy of SI data for disturbed sites. Better SI data is required on most openings so that accurate estimates of managed stand yields can be determined in the TSR process, and appropriate silviculture investment decisions can be facilitated. For units in which surveys are scheduled in the near future, this means ensuring that appropriate data is collected and the best available method of SI estimation is used. It was also suggested that the method of SI estimation be recorded and tracked to provide indications of reliability. For stands which are not scheduled for surveys in the near future (i.e. free growing stands), other methods will be required.	2
OGSI paired plots; local paired plots required There is concern amongst stakeholders over the use of localized (TSA OGSI corrections derived from broad (provincial) scale averaging of data. It should be noted, however, that OGSI adjustments affect only managed stand yield projections, and in most cases have no impact on short term harvest forecasts. Compared to currently available OGSI adjustments, the improved information provided by further sampling would primarily refine prediction of the LTHL, with minor adjustments possible in mid term forecasts. There is little if any opportunity to impact current practices or short term supply projections.	5
Improved data tracking and inventory updates; There is concern over the lack of data links between the silviculture reporting system (ISIS) and the inventory system. In particular, SI data from silviculture surveys is not always being transferred into the inventory system, and where transfer does occur there are often delays of several years. It should be noted, however, that while it is important to get accurate information from surveys into the inventory, delays in doing so have no impact on current practices. The largest impact of outdated information in the inventory is to predictions for the LTHL, with only minimal impacts if any on short term harvest level projections. Where the data exist, it is probable they will make it into the inventory long before it has an impact on short term harvest levels.	4
ISIS Improvements There is concern regarding the accuracy of information in the ISIS database particularly related to areas (sum of strata not equal to total) and disparities between opening files and ISIS records. An audit of the ISIS database is required to assess potential impacts of planning errors that could result from erroneous information, and to recommend improvements to the data management system.	3
Repressed 40-70 year old fire origin pine, thinning and fertilization trial. The practice of thinning 40-70 year old repressed pine stands has been viewed as risky from an investment stand point due to doubts about treatment response. There is some indication that fertilizer applications can dramatically improve treatment gains. ***A controlled trial is required to assess efficacy of thinning and fertilization treatments.*** Monitoring of disease (stem rust) effects in such trials was also suggested.	3
Fertilization trials in white spruce stands. There is widespread interest in fertilizing white spruce stands, but few response trials have been established. ***There is a need for white spruce fertilizer response data for all stand ages.*** Monitoring is also required to asses interaction of fertilizer application with pests of white spruce, in particular with the white pine weevil but also with small mammal damage.	3
Monitor intensive fertilization/CT regimes. An increase in commercial thinning is expected in the near future, providing opportunities for potential gains in mid-term timber supplies through fertilization. ***Controlled trials are required to asses fertilizer response in commercially thinned stands (all species)***.	3
Studies to collect better SIBEC data Accurate SI estimates are required for making informed decisions on silvicultural investments and for properly forecasting future timber supplies. In many stands, the only source of SI estimates is through correlation with site series. Currently, these relationships are weak or non-existent for many ecosystem units. SI values are often important criteria in making current silviculture investment decisions, and in many cases for juvenile stands SIBEC at least has the potential to provide the best estimate of SI. Also, in many cases correlation with SIBEC will be the source of the SI estimate that is carried in the inventory through the next rotation, particularly in stands where free growing status is achieved before a growth intercept estimate of SI can be completed. It is very important, therefor, that we immediately improve our SIBEC estimates of SI. ***More data collection is required to improve SI estimates for those sites that are currently poorly supported in the SIBEC database***.	2
Inventory audit/ VRI – accuracy of stand heights There is concern in the Vanderhoof Supply Block over potential height estimate errors in the inventory leading to errors in estimating yields of existing stands projected using VDYP; an audit is required to asses the magnitude of this problem. The problem may also be adequately addressed during VRI sampling, although a VRI has not yet been scheduled.	5

ESSF establishment and growth There is concern regarding regeneration performance in high elevation stands. While some studies have been conducted, more work is required to assess growth rate expectations for these stands in the ESSF zone. Of particular concern is for projected times (years) to green-up height.	6

MANAGEMENT UNIT SUSTAINABLE HARVEST PLAN – 2002-2007

2.3.6.7 ENHANCED FORESTRY PROGRAM

Prince George Forest District

Activities	Treatment Area Goals (ha)					Plan 2002/03	
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Surveys	1000	1000	1000	1000	1000	30.00	30000
Spacing	300	500	500	500	500	700.00	210000
Pruning	50	50	50	50	50	1000.00	50000
Fertilizing	300	300	600	600	1000	300.00	90000
Other	0	0	0	0	0	0.00	0
Totals hectares	1650	1850	2150	2150	2550	230.30	380,000
Planning and prescriptions							50,000
Total dollars							430,000

Forest Health Enhancement

Spacing	0	0	0	0	0	0.00	0
Pruning	0	0	0	0	0	0.00	0
Other treatments	0	0	0	0	0	0.00	0
Totals hectares	0	0	0	0	0	0.00	0

Habitat Supply and Biodiversity Enhancement

Treatments	0	0	0	0	0	0.00	0

Domestic Range

Treatments	0	0	0	0	0	0.00	0

Enhanced Forestry Activities - Management Unit Total

Surveys	1000	1000	1000	1000	1000	30.00	30,000
Spacing	300	500	500	500	500	700.00	210,000
Pruning	50	50	50	50	50	999.98	50,000
Fertilizing	300	300	600	600	1000	300.00	90,000
Other stand tending activities	0	0	0	0	0	0.00	0
Totals hectares	1650	1850	2150	2150	2550	230.30	380,000
Planning and prescriptions							50,000
Studies funding							25000
Total dollars							455,000

Vanderhoof Forest District

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	1000	1000	319	18	96	20.00	20000	
Spacing	862	740	740	740	740	650.00	560300	
Pruning	50	50	50	50	50	1100.00	55000	
Fertilizing	350	400	400	400	400	400.00	140000	
Other	0	0	0	0	0	0.00	0	
Totals hectares	2262	2190	1509	1208	1286	342.75	775,300	
Planning and prescriptions							20,000	
Total dollars							795,300	

Forest Health Enhancement

Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Other treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Habitat Supply and Biodiversity Enhancement

Riparian treatments	0	0	0	0	0	0.00	0	
Non-riparian treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Domestic Range

Treatments	0	0	0	0	0	0.00	0	

Enhanced Forestry Activities - Management Unit Total

Surveys	1000	1000	319	18	96	20.00	20,000	
Spacing	862	740	740	740	740	650.00	560,300	
Pruning	50	50	50	50	50	1,099.98	55,000	
Fertilizing	350	400	400	400	400	400.00	140,000	
Other stand tending activities	0	0	0	0	0	0.00	0	
Totals hectares	2262	2190	1509	1208	1286	342.75	775,300	
Planning and prescriptions							20,000	
Studies funding							0	
Total dollars							795,300	

Fort St. James Forest District

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	450	450	450	450	450	24.44	11000	
Spacing	136	260	260	260	260	700.00	95200	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	0	33	13	0	0	0.00	0	
Other	0	0	0	0	0	0.00	0	
Totals hectares	586	743	723	710	710	181.23	106,200	
Planning and prescriptions							0	
Total dollars							106,200	
Forest Health Enhancement								
Spacing	0	0	0	0	0	0.00	0	
Pruning	100	100	100	100	100	1,200.00	120000	
Other treatments	0	0	0	0	0	0.00	0	
Totals hectares	100	100	100	100	100	1,199.98	120,000	
Habitat Supply and Biodiversity Enhancement								
Riparian treatments	0	0	0	0	0	0.00	0	
Non-riparian treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Domestic Range								
Treatments	0	0	0	0	0	0.00	0	
Enhanced Forestry Activities - Management Unit Total								
Surveys	450	450	450	450	450	24.44	11,000	
Spacing	136	260	260	260	260	699.99	95,200	
Pruning	100	100	100	100	100	1,199.99	120,000	
Fertilizing	0	33	13	0	0	0.00	0	
Other stand tending activities	0	0	0	0	0	0.00	0	
Totals hectares	686	843	823	810	810	329.73	226,200	
Planning and prescriptions							0	
Studies funding							0	
Total dollars							226,200	

Prince George TSA Woodlots

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	0	0	0	0	0.00	0	
Spacing	73	50	50	50	50	616.44	45000	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	20	0	0	0	0	400.00	8000	
Other	0	0	0	0	0	0.00	0	
Totals hectares	93	50	50	50	50	569.87	53,000	
Planning and prescriptions							5,000	
Total dollars							58,000	

Forest Health Enhancement

Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Other treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Habitat Supply and Biodiversity Enhancement

Riparian treatments	0	0	0	0	0	0.00	0	
Non-riparian treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Domestic Range

Treatments	0	0	0	0	0	0.00	0	

Enhanced Forestry Activities - Management Unit Total

Surveys	0	0	0	0	0	0.00	0	
Spacing	73	50	50	50	50	616.43	45,000	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	20	0	0	0	0	400.00	8,000	
Other stand tending activities	0	0	0	0	0	0.00	0	
Totals hectares	93	50	50	50	50	569.84	53,000	
Planning and prescriptions							5,000	
Studies funding							0	
Total dollars							58,000	

Prince George TSA, TFL's 30, 42 and 53[4]

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	0	0	0	0	0.00	0	
Spacing	60	60	60	60	60	1750.00	105000	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	0	0	0	0	0	0.00	0	
Other	0	0	0	0	0	0.00	0	
Totals hectares	60	60	60	60	60	1749.88	105,000	
Planning and prescriptions							0	
Total dollars							105,000	

Forest Health Enhancement

Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Other treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Habitat Supply and Biodiversity Enhancement

Riparian treatments	0	0	0	0	0	0.00	0	
Non-riparian treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Domestic Range

Treatments	0	0	0	0	0	0.00	0	

Enhanced Forestry Activities - Management Unit Total

Surveys	0	0	0	0	0	0.00	0	
Spacing	60	60	60	60	60	1,749.97	105,000	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	0	0	0	0	0	0.00	0	
Other stand tending activities	0	0	0	0	0	0.00	0	
Totals hectares	60	60	60	60	60	1,749.71	105,000	
Planning and prescriptions							0	
Studies funding							0	
Total dollars							105,000	

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[4] Note! TFL data have been incorporated into the Forest District plans; they are presented here for information purposes only, and are not cumulative to the TSA total Enhanced Forestry Program.

2.3.6.8 BACKLOG FORESTRY PROGRAM

Prince George Forest District

Activities	Treatment Area Goals (ha)					Plan 2002/03	
Legal Obligations	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Surveys	500	500	1000	1000	1000	25.00	12500
Site preparation	0	0	0	0	0	0.00	
Planting	100	100	100	100	100	450.00	45000
Brushing	200	200	200	200	200	700.00	140000
Max. density spacing	0	0	0	0	0	0.00	
Totals hectares	800	800	1300	1300	1300	246.87	197,500
Seed purchase (per ha.)	100	100	100	100	100	450.00	45000
Total legal obligations							242,500
Backlog Reforestation							
Surveys	20000	18000	12000	7000	7000	30.00	600000
Site preparation	500	500	500	500	500	800.00	400000
Planting	100	600	600	500	500	450.00	45000
Brushing	500	500	500	500	500	650.00	325000
Totals hectares	21100	19600	13600	8500	8500	64.93	1,370,000
Seed purchase (per ha.)	200	600	600	500	500	450.00	90,000
Prescriptions and planning dollars							200,000
Total backlog reforestation							1,660,000
Impeded areas							
Surveys	15000	10000	5000	4000	4000	25.00	375000
Brushing	4000	4000	4000	2000	2000	700.00	2800000
Density spacing	0	0	0	0	0	0.00	0
Totals hectares	19000	14000	9000	6000	6000	167.11	3,175,000
Prescriptions and planning dollars							200,000
Total impeded areas							3,375,000
Site Restoration							
Fill planting	0	0	0	0	0	0.00	0
Rehabilitation	0	0	0	0	0	0.00	0
Reforestation	0	0	0	0	0	0.00	0
Totals hectares	0	0	0	0	0	0.00	0
Seed purchase	0	0	0	0	0	0.00	0
Prescriptions and planning							0
Total site restoration							0
Backlog Program Activities - Management Unit Total							
Surveys	35500	28500	18000	12000	12000	27.82	987500
Site preparation	500	500	500	500	500	800.00	400000
Planting	200	700	700	600	600	450.00	90000
Brushing	4700	4700	4700	2700	2700	694.68	3265000
Density spacing	0	0	0	0	0	0.00	0
Totals hectares	40900	34400	23900	15800	15800	115.95	4742500
Seed purchase (per ha.)	300	700	700	600	600	450.00	135000
Prescriptions and planning							400,000
Recommended studies							175,000
Total backlog program							5,452,500

Vanderhoof Forest District

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Legal Obligations	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	247	161	63	81	0	30.00	7410	
Site preparation	0	0	0	0	0	0.00	0	
Planting	7	0	0	0	0	550.00	3850	
Brushing	15	0	0	0	0	650.00	9750	
Max. density spacing	84	0	0	0	0	650.00	54600	
Totals hectares	353	161	63	81	0	214.19	75,610	
Seed purchase	0	0	0	0	0	0.00	0	
Total legal obligations							75,610	
Backlog Reforestation								
Surveys	300	300	49	23	0	30.00	9000	
Site preparation	50	0	0	0	0	900.00	45000	
Planting	50	50	0	0	0	550.00	27500	
Brushing	0	0	0	0	0	0.00	0	
Totals hectares	400	350	49	23	0	203.75	81,500	
Seed purchase	0	0	0	0	0	0.00	0	
Prescriptions and planning dollars							0	
Total backlog reforestation							81,500	
Impeded areas								
Surveys	7400	2611	1367	1062	300	30.00	222000	
Brushing	650	200	21	2	34	650.00	422500	
Density spacing	400	277	0	0	0	650.00	260000	
Totals hectares	8450	3088	1388	1064	334	107.04	904,500	
Prescriptions and planning dollars							0	
Total impeded areas							904,500	
Site Restoration								
Fill planting	0	0	0	0	0	0.00	0	
Rehabilitation	0	0	0	0	0	0.00	0	
Reforestation	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Seed purchase	0	0	0	0	0	0.00	0	
Prescriptions and planning dollars							0	
Total site restoration							0	

Backlog Program Activities - Management Unit Total

Surveys	7947	3072	1479	1166	300	30.00	238410
Site preparation	50	0	0	0	0	899.96	45000
Planting	57	50	0	0	0	549.98	31350
Brushing	665	200	21	2	34	650.00	432250
Density spacing	484	277	0	0	0	650.00	314600
Totals hectares	9203	3599	1500	1168	334	115.35	1061610
Seed purchase	0	0	0	0	0	0.00	0
Prescriptions and planning							0
Recommended studies							0
Total backlog program							1,061,610

Fort St. James Forest District

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Legal Obligations	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	500	350	275	150	150	23.75	11875	
Site preparation	0	0	0	0	0	0.00	0	
Planting	75	0	0	0	0	300.00	22500	
Brushing	35	25	0	0	0	750.00	26250	
Max. density spacing	135	0	0	0	0	700.00	94500	
Totals hectares	745	375	275	150	150	208.22	155,125	
Seed purchase	0	0	0	0	0	0.00	0	
Total legal obligations							155,125	
Backlog Reforestation								
Surveys	2900	1400	1200	1200	1200	23.00	66700	
Site preparation	0	0	0	0	0	0.00	0	
Planting	569	590	245	240	240	300.00	170700	
Brushing	100	100	100	100	100	750.00	75000	
Totals hectares	3569	2090	1545	1540	1540	87.53	312,400	
Seed purchase	569	590	245	240	240	650.26	370,000	
Prescriptions and planning dollars							0	
Total backlog reforestation							682,400	
Impeded areas								
Surveys	7000	7000	6000	6000	6000	23.00	161000	
Brushing	2530	2150	1500	1000	1000	750.00	1897500	
Density spacing	150	150	150	150	150	700.00	105000	
Totals hectares	9680	9300	7650	7150	7150	223.50	2,163,500	
Prescriptions and planning dollars							145,000	
Total impeded areas							2,308,500	
Site Restoration								
Fill planting	0	0	0	0	0	0.00	0	
Rehabilitation	0	0	0	0	0	0.00	0	
Reforestation	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Seed purchase	0	0	0	0	0	0.00	0	
Prescriptions and planning dollars							0	
Total site restoration							0	

Backlog Program Activities - Management Unit Total

Surveys	10400	8750	7475	7350	7350	23.04	239575	
Site preparation	0	0	0	0	0	0.00	0	
Planting	644	590	245	240	240	300.00	193200	
Brushing	2665	2275	1600	1100	1100	750.00	1998750	
Density spacing	285	150	150	150	150	700.00	199500	
Totals hectares	13994	11765	9470	8840	8840	188.01	2631025	
Seed purchase	569	590	245	240	240	650.26	370000	
Prescriptions and planning							145,000	
Recommended studies							35,000	
Total backlog program							3,181,025	

Prince George TSA Woodlots

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Legal Obligations	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	0	0	0	0	0.00	0	
Site preparation	0	0	0	0	0	0.00	0	
Planting	0	0	0	0	0	0.00	0	
Brushing	0	0	0	0	0	0.00	0	
Max. density spacing	50	50	50	50	50	1,200.00	60000	
Totals hectares	50	50	50	50	50	1,199.90	60,000	
Seed purchase	0	0	0	0	0	0.00	0	
Total legal obligations							60,000	

Backlog Reforestation

Surveys	1300	800	600	600	500	30.00	39000	
Site preparation	100	50	50	50	50	400.00	40000	
Planting	150	150	150	150	150	500.00	75000	
Brushing	446	400	300	300	300	784.75	350000	
Totals hectares	1550	1000	800	800	700	325.16	504,000	
Seed purchase	27	0	0	0	0	370.37	10,000	
Prescriptions and planning dollars							42,000	
Total backlog reforestation							556,000	

Impeded areas

Surveys	1000	500	500	0	0	0.00	30000	
Brushing	0	0	0	0	0	0.00	0	
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	1000	500	500	0	0	0.00	30000	
Prescriptions and planning dollars							0	
Total impeded areas							0	

Site Restoration

Fill planting	0	0	0	0	0	0.00	0	
Rehabilitation	0	0	0	0	0	0.00	0	
Reforestation	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Seed purchase	0	0	0	0	0	0.00	0	
Prescriptions and planning dollars							0	
Total site restoration							0	

Backlog Program Activities - Management Unit Total

Surveys	2300	1300	1100	600	500	16.96	69000	
Site preparation	100	50	50	50	50	399.99	40000	
Planting	150	150	150	150	150	499.99	75000	
Brushing	150	150	150	150	150	2,333.30	350000	
Density spacing	50	50	50	50	50	1,199.98	60000	
Totals hectares	2750	1700	1500	1000	900	205.09	594000	
Seed purchase	27	0	0	0	0	370.34	10000	
Prescriptions and planning							42,000	
Recommended studies							0	
Total backlog program							646,000	

Prince George TSA, TFL's 30, 42 and 53[5]

Activities	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Legal Obligations							
Surveys	0	0	0	0	0	0.00	0
Site preparation	0	0	0	0	0	0.00	0
Planting	0	0	0	0	0	0.00	0
Brushing	0	0	0	0	0	0.00	0
Max. density spacing	0	0	0	0	0	0.00	0
Total legal obligations							0
Backlog Reforestation							
Surveys	3500	800	800	800	0	31.14	109000
Site preparation	76	30	30	0	0	1,006.58	76500
Planting	10	0	0	0	0	1,000.00	10000
Brushing	600	100	100	100	100	585.00	351000
Totals hectares	4186	930	930	900	100	130.55	546,500
Seed purchase	0	0	0	0	0	0.00	0
Prescriptions and planning dollars							0
Total backlog reforestation							546,500
Impeded areas							
Surveys	0	0	0	0	0	0.00	0
Brushing	0	0	0	0	0	0.00	0
Density spacing	0	0	0	0	0	0.00	0
Total impeded areas							0
Site Restoration							
Fill planting	0	0	0	0	0	0.00	0
Rehabilitation	0	0	0	0	0	0.00	0
Reforestation	0	0	0	0	0	0.00	0
Total site restoration							0
Backlog Program Activities - Management Unit							
Surveys	3500	800	800	800	0	31.14	109000
Site preparation	76	30	30	0	0	1,006.55	76500
Planting	10	0	0	0	0	999.70	10000
Brushing	600	100	100	100	100	585.00	351000
Density spacing	0	0	0	0	0	0.00	0
Totals hectares	4186	930	930	900	100	130.55	546500
Seed purchase	0	0	0	0	0	0.00	0
Prescriptions and planning							0
Recommended studies							50,000
Total backlog program							596,500

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[5] Note! TFL data have been incorporated into the Forest District plans; they are presented here for information purposes only, and are not cumulative to the TSA total BacklogForestry Program.

2.3.6.9 MANAGEMENT UNIT COMPONENT FRBC PERFORMANCE TABLES

Prince George Forest District

	Performance Measure	Tree Improve-ment	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
	Inputs											
A	**Planned treatment area (ha) in 2002/2003**	300	0	27,375	500	200	4,700	300	50	300	33,725	
1.0	**Timber Supply**											
1.1	Potential volume/ha gain (m3/ha/yr)	0.34	0	0.25	0	1.9	0.25	0	0	0.40		
1.2	Years the factor will apply	80	65	65	65	80	80	80	65	65		
1.3	Pot. total merch. volume increment in 65 years (m3)	8,160	0	444,844	0	30,400	94,000	0	0	7,800		**585,204**
1.4	Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4	Est. area that will be reclassified as stocked (ha)			5,000								**5,000**
1.5	Est. area that will be declared as free growing (ha)			15,000								**15,000**
2.0	**Wood Value**											
2.1	Percent improvement in total value at harvest (Compared to no treatment)							10	15	3		
3.0	**Employment**											
3.1	Estimated short term employment (person days/ha)	0.1	0.34	0.05	0.5	0.6	3	3	3.5	0.1	0.1	
3.2	Estimated total employment (person days/year)	30	0	1,369	250	120	14,100	900	175	30	3,373	
3.3	Estimated total full time equivalent positions (FTE)	0	0	8	1	1	78	5	1	0	19	**113**
4.1	**Forest Health Enhancement (ha)**											**0**
5.1	**Habitat Supply**											
5.2	Planned area for specific wildlife forage or habitat creation in 2001/2002 (ha)											**0**
5.3	Est. area with secondary value provided to biodiversity (ha)											**500**

Vanderhoof Forest District

	Performance Measure	Tree Improvement	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
	Inputs											
A	**Planned treatment area (ha) in 2002/2003**	57	0	1,120	50	57	665	1,346	50	350	3,695	
1.0	**Timber Supply**											
1.1	Potential volume/ha gain (m3/ha/yr)	0.41	0	0	0	2.9	0.41	0.25	0	0.40		
1.2	Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3	Pot. total merch. volume increment in 65 years (m3)	1,519	0	0	0	10,893	17,722	21,873	0	9,100		**61,107**
1.4	Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4	Est. area that will be reclassified as stocked (ha)			900								**900**
1.5	Est. area that will be declared as free growing (ha)			2,240								**2,240**
2.0	**Wood Value**											
2.1	Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0	**Employment**											
3.1	Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	2	2.61	3.96	4.54	0.18	0.1	
3.2	Estimated total employment (person days/year)	6	0	112	48	114	1,736	5,330	227	63	370	
3.3	Estimated total full time equivalent positions (FTE)	0	0	1	0	1	10	30	1	0	2	**44**
4.1	**Forest Health Enhancement (ha)**											**0**
5.1	**Habitat Supply**											
5.2	Planned area for specific wildlife forage or habitat maintenance in 2002/2003 (ha)											**0**
5.3	Est. area with secondary value provided to biodiversity (ha)											**0**

Fort St. James Forest District

	Performance Measure	Tree Improvement	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
	Inputs											
A	**Planned treatment area (ha) in 2002/2003**	644	0	1,360	0	644	2,665	421	100	0	5,834	
1.0	**Timber Supply**											
1.1	Potential volume/ha gain (m3/ha/yr)	0.41	0	0	0	2.9	0.41	0.25	0	0.40		
1.2	Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3	Pot. total merch. volume increment in 65 years (m3)	17,163	0	0	0	123,069	71,022	6,841	0	0		**218,095**
1.4	Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4	Est. area that will be reclassified as stocked (ha)			1,085								**1,085**
1.5	Est. area that will be declared as free growing (ha)			2,700								**2,700**
2.0	**Wood Value**											
2.1	Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0	**Employment**											
3.1	Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	2	2.61	3.96	4.54	0.18	0.1	
3.2	Estimated total employment (person days/year)	64	0	136	0	1,288	6,956	1,667	454	0	583	
3.3	Estimated total full time equivalent positions (FTE)	0	0	1	0	7	39	9	3	0	3	**62**
4.1	**Forest Health Enhancement (ha)**											**100**
5.1	**Habitat Supply**											
5.2	Planned area for specific wildlife forage or habitat maintenance in 2002/2003 (ha)											**0**
5.3	Est. area with secondary value provided to biodiversity (ha)											**0**

Prince George TSA Woodlots

	Performance Measure	Tree Improvement	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
	Inputs											
A	**Planned treatment area (ha) in 2002/2003**	150	0	900	100	150	150	123	0	20	1,593	
1.0	**Timber Supply**											
1.1	Potential volume/ha gain (m3/ha/yr)	0.41	0	0	0	2.9	0.41	0.25	0	0.40		
1.2	Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3	Pot. total merch. volume increment in 65 years (m3)	3,998	0	0	0	28,665	3,998	1,999	0	520		**39,179**
1.4	Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4	Est. area that will be reclassified as stocked (ha)			225								**225**
1.5	Est. area that will be declared as free growing (ha)			180								**180**
2.0	**Wood Value**											
2.1	Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0	**Employment**											
3.1	Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	2	2.61	3.96	4.54	0.18	0.1	
3.2	Estimated total employment (person days/year)	15	0	90	95	300	392	487	0	4	159	
3.3	Estimated total full time equivalent positions (FTE)	0	0	1	1	2	2	3	0	0	1	**9**
4.1	**Forest Health Enhancement (ha)**											**0**
5.1	**Habitat Supply**											
5.2	Planned area for specific wildlife forage or habitat maintenance in 2002/2003 (ha)											**0**
5.3	Est. area with secondary value provided to biodiversity (ha)											**0**

Prince George TSA, TFL's 30, 42 and 53[6]

	Performance Measure	Tree Improve-ment	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
	Inputs											
A	**Planned treatment area (ha) in 2002/2003**	10	0	1,750	76	10	600	60	0	0	2,506	
1.0	**Timber Supply**											
1.1	Potential volume/ha gain (m3/ha/yr)	0.41	0	0	0	2.9	0.41	0.25	0	0.40		
1.2	Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3	Pot. total merch. volume increment in 65 years (m3)	267	0	0	0	1,912	15,990	975	0	0		**19,143**
1.4	Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4	Est. area that will be reclassified as stocked (ha)			440								**440**
1.5	Est. area that will be declared as free growing (ha)			350								**350**
2.0	**Wood Value**											
2.1	Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0	**Employment**											
3.1	Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	2	2.61	3.96	4.54	0.18	0.1	
3.2	Estimated total employment (person days/year)	1	0	175	72	20	1,566	238	0	0	251	
3.3	Estimated total full time equivalent positions (FTE)	0	0	1	0	0	9	1	0	0	1	**13**

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[6] Note! TFL data have been incorporated into the Forest District plans; they are presented here for information purposes only, and are not cumulative to the TSA total SH Plan.

2.3.6.10 MANAGEMENT UNIT COMPONENT SUMMARY TABLES

Prince George Forest District

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	1,650	1,850	2,150	2,150	2,550	230	380,000
Planning, prescriptions and seedlings							75,000
Backlog Program Field Activities	40,900	34,400	23,900	15,800	15,800	116	4,742,500
Planning, prescriptions and seedlings							710,000
Totals	42,550	36,250	26,050	17,950	18,350		5,907,500

Performance Measures

Potential total merchentable volume increment in 65 years	585,204 m^3
Estimated ha that will be reclassified as stocked	5,000 ha
Estimated ha that will be declared as free growing	15,000 ha
Estimated total full time equivalent positions generated	113 FTEs
Forest health enhancement area	0 ha
Planned area for specific wildlife forage or habitat creation	0 ha
Estimated area with secondary value provided to biodiversity	500 ha

Vanderhoof Forest District

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	2,262	2,190	1,509	1,208	1,286	343	775,300
Planning, prescriptions and seedlings							20,000
Backlog Program Field Activities	9,203	0	0	0	0	115	1,061,610
Planning, prescriptions and seedlings							0
Totals	11,465	2,190	1,509	1,208	1,286		1,856,910

Performance Measures

Potential total merchentable volume increment in 65 years	61,107 m^3
Estimated ha that will be reclassified as stocked	900 ha
Estimated ha that will be declared as free growing	2,240 ha
Estimated total full time equivalent positions generated	44 FTEs
Forest health enhancement area	0 ha
Planned area for specific wildlife forage or habitat maintenance	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

Fort St. James Forest District

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	686	843	823	810	810	330	226,200
Planning, prescriptions and seedlings							0
Backlog Program Field Activities	13,994	11,765	9,470	8,840	8,840	188	2,631,025
Planning, prescriptions and seedlings							550,000
Totals	14,680	12,608	10,293	9,650	9,650		3,407,225

Performance Measures

Potential total merchentable volume increment in 65 years	218,095 m^3
Estimated ha that will be reclassified as stocked	1,085 ha
Estimated ha that will be declared as free growing	2,700 ha
Estimated total full time equivalent positions generated	62 FTEs
Forest health enhancement area	100 ha
Planned area for specific wildlife forage or habitat maintenance	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

Prince George TSA Woodlots

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	50	50	50	50	50	600	53000
Planning, prescriptions and seedlings							5,000
Backlog Program Field Activities	2,250	0	0	0	0	231	594,000
Planning, prescriptions and seedlings							52,000
Totals	2,300	50	50	50	50		704,000

Performance Measures

Potential total merchentable volume increment in 65 years	38,286 m^3
Estimated ha that will be reclassified as stocked	225 ha
Estimated ha that will be declared as free growing	180 ha
Estimated total full time equivalent positions generated	8 FTEs
Forest health enhancement area	0 ha
Planned area for specific wildlife forage or habitat maintenance	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

Prince George TSA, TFL's 30, 42 and 53[7]

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	60	60	60	60	60	1,750	105,000
Planning, prescriptions and seedlings							0
Backlog Program Field Activities	4,186	0	0	0	0	131	546,500
Planning, prescriptions and seedlings							50,000
Totals	4,246	60	60	60	60		701,500

Performance Measures

Potential total merchentable volume increment in 65 years	19,143 m^3
Estimated ha that will be reclassified as stocked	440 ha
Estimated ha that will be declared as free growing	350 ha
Estimated total full time equivalent positions generated	13 FTEs
Forest health enhancement area	0 ha
Planned area for specific wildlife forage or habitat maintenance	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

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[7] Note! TFL data have been incorporated into the Forest District plans; they are presented here for information purposes only, and are not cumulative to the TSA total SH Plan.

Prince George TSA Cumulative Summary

	Treatment Area Goals (ha)						Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007		Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	0	0	0	0	0		0	0
DPG	1,650	1,850	2,150	2,150	2,550		230	380,000
DVA	2,262	2,190	1,509	1,208	1,286		343	775,300
DJA	686	843	823	810	810		330	226,200
Woodlots	50	50	50	50	50		600	30,000
Planning, prescriptions and seedlings								5,000
DPG								75,000
DVA								20,000
DJA								0
Woodlots								
Backlog Program Field Activities	0	0	0	0	0		0	0
DPG	40,900	34,400	23,900	15,800	15,800		116	4,742,500
DVA	9,203	0	0	0	0		115	1,061,610
DJA	13,994	11,765	9,470	8,840	8,840		188	2,631,025
Woodlots	2,250	0	0	0	0		231	519,000
Planning, prescriptions and seedlings								42,000
DPG								710,000
DVA								0
DJA								550,000
Woodlots								
Totals	**70,995**	**51,098**	**37,902**	**28,858**	**29,336**	**0**	**2,153**	**11,767,635**

Performance Measures	DPG	DVA	DJA	WL	**TOTAL**
Potential total merchentable volume increment in 65 years	585204	61107	218095	38286	**902692** m^3
Estimated ha that will be reclassified as stocked	5000	900	1085	225	**7210** ha
Estimated ha that will be declared as free growing	15000	2240	2700	180	**20120** ha
Estimated total full time equivalent positions generated	113	44	62	8	**227** FTEs
Forest health enhancement area	0	0	100	0	**100** ha
Planned area for specific wildlife forage or habitat maintenance	0	0	0	0	**0** ha
Estimated area with secondary value provided to biodiversity	500	0	0	0	**500** ha

2.4 ROBSON VALLEY TSA SUSTAINABLE HARVEST ISSUES AND SILVICULTURAL STRATEGY

This section describes the key sustainable harvest issues in the Robson Valley TSA, and defines a provisional silvicultural strategy to address them. The following strategic analysis is based on a recently completed Type I Silvicultural Analysis, but requires further, detailed forest analysis and modelling in a Type II analysis. This step is currently underway, and the results will be incorporated into the 2003 Sustainable Harvest RMP. In the meantime, this provisional strategy is reflected in the proposed, 5 year Sustainable Harvest Plan for the Robson Valley Forest District (Section 2.8).

2.4.1 THE RESOURCE LAND-BASE

The Robson Valley TSA covers 1,235, 821 hectares, of which 209,365 (17%) is considered to be in the timber harvesting land base.

The site class profile of the timber harvesting land base is: 54% poor, 30% medium and 16% good site.

The current age class profile (Figure 2.2.1) of the timber harvesting land base is skewed toward older age classes. Over 70% of the stands are 100 years of age or older, and 60% of the stands are 200 years of age or older.

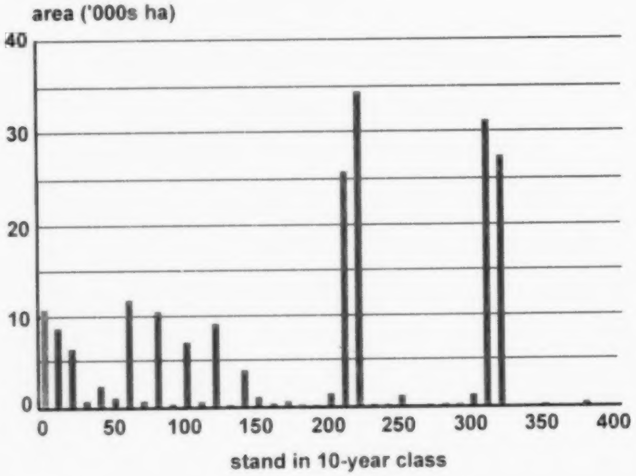

Figure 2.4.1 **Current age class distribution—timber harvesting land base, Robson Valley TSA 1994**

The tree species profile (Figure 2.2.2) on the timber harvesting land base is approximately 45% spruce, 19% sub-alpine fir, 13% lodgepole pine, 10% western red cedar, 8% western hemlock, and 5% Douglas-fir. Spruce stands over 100 years of age account for more than 33% of the timber harvesting land base.

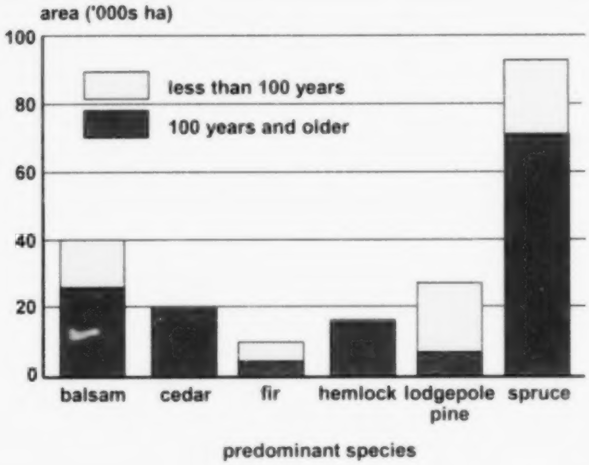

Figure 2.2.2 **Current species composition – timber harvesting land base, Robson Valley TSA 1994.**

The Watersheds BC database classifies forests stands by age and disturbance, and is useful for identifying habitat issues. In Figure 2.2.3, old forests are defined as age >140 years, young forests are age <140 years, recently logged forests are age ≤ 20 years, selectively logged forests are forests selectively logged during the last 20 years, and burned forests are forests burned during the last 20 years. The maps used to create this database were based on data from 1992-1993. Therefore any areas burned or logged in the last 6 or 7 years are not reflected by this data. Figure 2.2.3 illustrates the concentration of harvesting on low slope gradient forests in the last 20 (27) years.

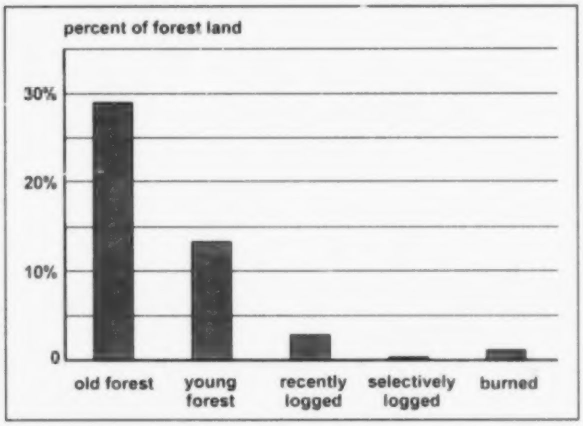

Figure 2.2.3 **Forest classification—timber harvesting land base, Robson Valley TSA 1994.**

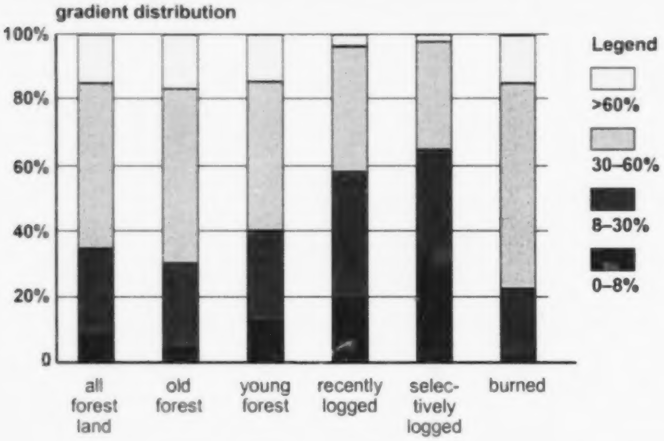

Figure 2.4.4 **Slope gradient of forest classification —timber harvesting land base, Robson Valley TSA 1994.**

2.4.2 RESOURCE SUPPLY ISSUES

2.4.2.1 TIMBER SUPPLY – VOLUME

The timber supply is declining. The most important factor is the abundance of old growth timber that has allowed harvesting above the long-term harvest level. The regenerating stands will be harvested at a younger age and smaller size than the old growth stands, and there will be less timber volume available to harvest. Forest cover requirements for other resources such as wildlife habitat and visual quality also limit timber harvesting.

Existing stand volumes - Sensitivity analyses performed for the 1994 timber supply review indicated that the short-term timber supply is very sensitive to changes in volumes of existing stands. Even moderate changes in assumptions resulted in initial harvests more than 40% lower than the base case or conversely, the initial harvest level being maintained for 3 decades. CH types and higher elevation SB were specifically identified in the workshop as having low volumes, and the SB may have less spruce than indicated by the type label.

Visually sensitive areas – Advance TSR2 results described by participants suggest that VQOs will have a substantial impact on the timber supply and methods to mitigate these effects are a high priority. Managing visual quality is an important issue in the district particularly in the Rocky Mountain Trench, and adjacent to Jasper National Park and the provincial parks that surround the district. Harvesting and silviculture operations must conform with the visual quality objectives. In the trench they are primarily retention and partial retention.

Unsalvaged losses – Unsalvaged losses in TSR1 were estimated at 70 500 m^3 but have increased to 98 600 m^3 in TSR2. Of the TSR2 unsalvaged losses, 53 056 m^3 (57%) is insect related, predominantly due to hemlock looper.

Biodiversity constraints – Forest cover constraints in TSR2 have increased substantially and can be expected to constrain timber supply from natural stands.

Other uncertainties – TSR1 indicates that uncertainties about minimum harvestable ages, green-up requirements, and visual quality objectives have moderate impacts on short-term harvest levels, while uncertainty about regenerated yields has a moderate impact on long term harvest level.

2.4.2.2 TIMBER SUPPLY – QUALITY

No studies on timber quality have been completed for Robson Valley District and no information on timber quality is available from the 1994 timber supply review. It is noted, however, that low volume CH and high elevation SB stands are of low quality.

2.4.2.3 HABITAT SUPPLY

Riparian values – There are areas in the TSA that have significant portions of streams logged to the bank. These are obvious areas for some silvicultural investments to stabilize banks, grow shade for the streams and restore the functioning of streamside vegetation as habitat and the energetics of stream foodchains. Accompanying maps highlight those areas that have the highest level of streamside logging. In the 7 years since the data was collected for this map, there has been additional logging, some of it prior to the implementation of FPC riparian standards. This activity may have put other watersheds at risk.

Cedar – Hemlock stands– The Robson Valley TSA represents some of the furthest extent of the ICH biogeoclimatic zone. Examples of this zone are often old cedar-hemlock stands that are not desireable for timber, but are good wildlife habitat. Old looper killed or damaged stands are ideal for cavity nesters. This damage represents a large stand-initiating event. Shade tolerant species are coming up in these stands. Logging these areas means conversion to spruce stands. Because these stands are part of the timber harvesting land base, the chief forester has admonished the district to cut these areas in the proportion in which they are found (17%) or else they may be removed from the THLB in the next determination (i.e. a lower AAC). From a habitat point of view, removal of these stands from the THLB is the preferred solution.

Mountain Caribou – The Robson Valley is at the northern end of the range of mountain caribou in BC. These arboreal lichen foraging caribou are considered at risk in the province. There is a system of zonation for caribou habitat in the TSA including zones for high value habitat (deferral or no logging), medium value (small patch cutting or group selection) and corridors (no more than 10% not greened up). Further silvicultural investments may be suggested by some research currently underway (S. Stevenson, M. Jull, D. Coxson, H. Armleder and B. McClellan). Recommendations will be forthcoming from this group at the end of the current fiscal year . They will be published by MOE and/or MELP.

The bottom line is that the best strategy for mountain caribou is not to log at all. If you are determined to log, then partial cutting techniques that remove clumps of trees will maintain some of the habitat values. Specifics about ways to log will be in the recommendations. If high value habitat has already been logged, then possible techniques for restoring the habitat as quickly as possible include planting and thinning to create clumpiness and maintaining this clumpiness through partial cutting techniques.

Lichens require light. Thinning allows light to penetrate into the stand and allows lichens to grow on more surfaces than just the top of the canopy. Canopies that are partially defoliated also have a beneficial effect on lichen growth.

Grizzly Bear – Stocking standards in grizzly bear habitat should be examined to make sure stands are not so dense as to exclude the growth of forage species (berry producing deciduous shrubs and trees and herbaceous plants). Herbicides should not be used in these stands.

2.4.2.4 RESOURCE EMPLOYMENT

Employment is also an important issue as the number of timber harvesting jobs has decreased significantly in recent years, and will likely continue to decrease as the timber supply declines. Silviculture employment, however, favours non-local crews due to the short employment season. Residents dependent on the forest industry occupy higher paying harvesting jobs or leave the district.

Timber supply is often the dominating issue on British Columbia management units. The objective of this section is to identify aspects of the timber harvesting land base and its management that govern the supply of timber from the TSA. This information provides the basis for identifying the constraining mechanisms that shape the timber supply forecast for the unit and for specifying possible silvicultural remedies. Unless otherwise indicated, the data in section is drawn from the Robson Valley TSA Timber Supply Analysis (1994).

2.4.3 SILVICULTURAL PRACTICES

2.4.3.1 SILVICULTURAL HISTORY

Table 2.2.1 records both backlog (pre-1987 openings) and incremental silviculture for the TSA. From 1990 to 1999, a total of 14.4 hectares were pruned (first lift) in 1998. Potential for incremental pruning is unknown. The pruning that was proposed in the FRBC resource management plan is to treat for blister rust in young white pine stands.

Table 2.2.1 Backlog and incremental silviculture history 1990-99 , Robson Valley TSA.

Year	Backlog Planting (ha)	Backlog Brushing (ha)	Juvenile Spacing (ha)
1990	2763	323	53
1991	548	544	76
1992	178	472	228
1993	100	134	25
1994	440	329	0
1995	39	199	0
1996	267	438	0
1997	0	198	0
1998	32	28	14
1999	4	10	0
Total	**4,371**	**2,674**	**396**

2.4.3.2 BACKLOG SILVICULTURE

Backlog treatments have consisted of primarily planting and brushing. See Table 2.2.1 for annual details. The area of backlog not satisfactorily restocked land is 1515 ha according to the TSR2 data package.

2.4.3.3 PRECOMMERCIAL THINNING

There is no "typical" precommercial thinning (juvenile spacing) regime in the district. There is no incremental plan where stands are targeted for treatment. In 1997 the district began to identify candidate stands, but the enthusiasm for the project waned when the District's forest renewal funding was discontinued. While licensees would like to undertake incremental work, the current priority is to brush impeded stands and conduct silvicultural surveys. If funding were not a concern, approximately 300 hectares could be precommercially thinned per year.

2.4.3.4 TREE IMPROVEMENT

Genetic gain has been considered through sensitivity analysis in TSR2 as a yield increase of 18% for all spruce planted from after 1999. The projected gain from improved seed for the Robson

Valley TSA is listed in Table 2.2.2. Note that A class pine or Douglas fir seed has not yet been planted on the TSA but is included in Table 2.2.2 to demonstrate potential gains.

Table 2.2.2 Forecast gain in volume from improved seed for the Robson Valley TSA

	Elevation	Gain from Improved Seed (%)		
Species & Seed Zone	**(m)**	**98-99**	**99-00**	**2007-08**
Pli PG low	<1100	6	6	7
Sx PG low	<1200	14	15	17
Sx PG high	<1200	17	17	16
Sx NE low	<1300	2	4	12
Sx NE high	1300 - 1700	2	5	13
Fdi QL all	all	9	9	9

Source: Forest Genetics Council of BC.

2.4.4 TSR1 MANAGEMENT ASSUMPTIONS

In addition to the inventory, or current state of the forest, assumptions about how it will be managed are essential for defining the silviculture strategy.

2.4.4.1 INVENTORY PROFILE

The inventory profile (species composition) of the timber harvesting land base will change over time with harvesting and replanting. Table 2.2.3 indicates the trend in species profile resulting from the harvesting schedule of the TSR base case.

Table 2.2.3 Current inventory profile and conversion trends, Robson Valley TSA 1994.

	Percent of Inventory			Future
Species	**Present**	**Future**	**Conversion**	**Rounded**
S	44	83		80
Bl	19	4	(15% to S)	5
Pl	13	7	(6% to S)	5
Cw	10	0	(2% to Fd, 8% to S)	3
Hw	9	0	(9% to S)	2
Fdi	5	6	(2% from Cw, 1% to S)	5
Total	100	100		100
Source: TSR Robson Valley TSA Timber Supply Analysis 1994				

2.4.4.2 MANAGEMENT ZONES AND FOREST COVER REQUIREMENTS

The TSR management zones and their associated forest cover requirements are listed in Table 2.2.4 and the minimum harvest ages are summarized in Table 2.2.5.

Table 2.2.4 Management zones and forest cover requirements, Robson Valley TSA 1994

Management Zone		% THLB Area	Height 1 (meters)	Age 1 (years)	Maximum % area younger than Age 1	Height 2 (meters)	Age 2 (years)	Minimum % area older than Age 2
1	landscape partial retention	12.0	5	26	10			
2	landscape retention	1.4	5	26	3			
3	caribou - high	0.0		100%	Excluded			
4	caribou - moderate	7.5	3	27	33		80	67
5	caribou - low	2.0		Partial	Cut zone			
6	reserve	0.0		100%	Excluded			
7	landscape modification	7.1	5	26	25			
8	IRM	65.2	3	23	33			
9	old-growth	4.8	3	22	25		200	5

Source: TSR Robson Valley TSA Timber Supply Analysis 1994, p60.

2.4.4.3 HARVESTING PRACTICES

The average area harvested is 1 858 ha/ year. This was calculated using the total volume logged by all licensees in the last five years (2 443 898 m3) divided by an estimate of the average volume (263 m3/ha) which equals the total area harvested over 5 years (9 292 hectares). This was divided by five years to equal 1858 ha/year. One hundred percent of the volume is even-aged management.

The total annual harvested area is likely to decrease slightly as the timber supply is projected to decline 10 percent per decade. The percentage of even-aged management may also decrease as uneven-aged management is used to address non-timber resource values such as visual quality.

Table 2.2.5 Minimum harvestable ages by leading species and site class, Robson Valley TSA 1994

Species	Site: G	M	P
Fdi	90	120	140
Pl	80	90	100
S	100	110	120

2.4.5 TIMBER SUPPLY DYNAMICS AND THE AAC

The 1994 TSR, upon which the current AAC determination was based, shows the allowable annual cut can be maintained for 10 years without causing a reduction in future harvest levels below the long-term level (see Figure 2.2.5). After 10 years the harvest declines at 10% each decade until the long term is reached in the sixth decade. The long-term harvest level, the potential maximum that can be harvested in perpetuity, is about 351 000 cubic metres per year, a 41% decline from the initial harvest level.

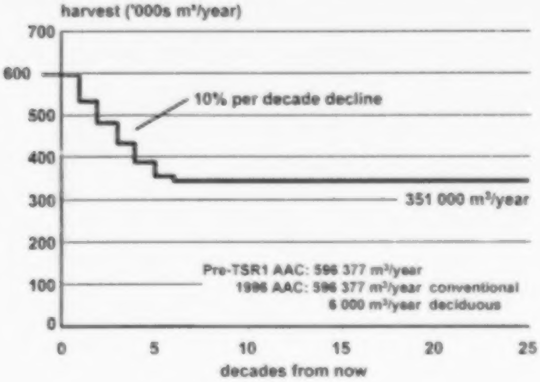

Figure 2.2.5 **Base harvest forecast, Robson Valley TSA.**

The steep decline from current harvesting levels to a much lower long term harvest level is characteristic of management units where the remaining mature timber is being rapidly depleted. Figure 2.2.6 overlays the forecast levels of total and harvestable growing stock on the base case, demonstrating that the timing of the reduction of the stock coincides with the fall down in harvest.

2.4.5.1 TRANSITION FROM NATURAL TO MANAGED STANDS

The transition of the harvest from old growth to predominantly second growth is also plotted on Figure 2.2.6. Note that this transition line is an estimate – this information was not reported from the TSR1 analysis. The transition curve helps identify the response frameworks for developing a silvicultural strategy - the end of the mid term and beginning of the long term is the point at which the harvest is predominantly dependent on managed stands. This point is approximately 130 years from now for the Robson Valley TSA. The short term is arbitrarily defined as the first 20 years.

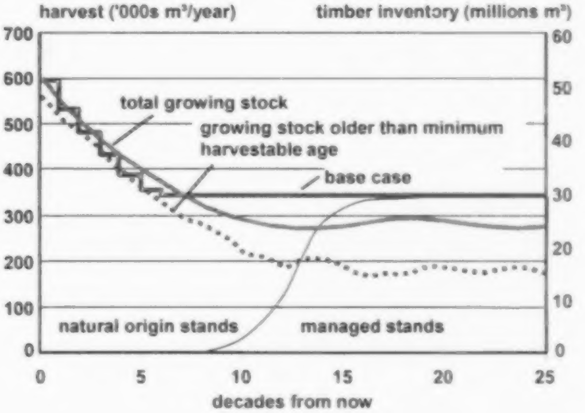

Figure 2.2.6 **Total and harvestable growing stock and harvest composition, Robson Valley TSA.**

2.4.5.2 SCARCITY OF HARVESTABLE TIMBER IN LATE MID-TERM

Figure 2.2.7 displays the age distribution of the timber harvesting land base currently, and in 50 and 100 years. Harvesting is concentrated in the age 310-320 (currently) for the first 50 years, and then in the 210-220 ages (currently) until 100 years. After 100 years (not shown) the harvest shifts to stands age 120+ years and is down to stands age 80+ years after 200 years.

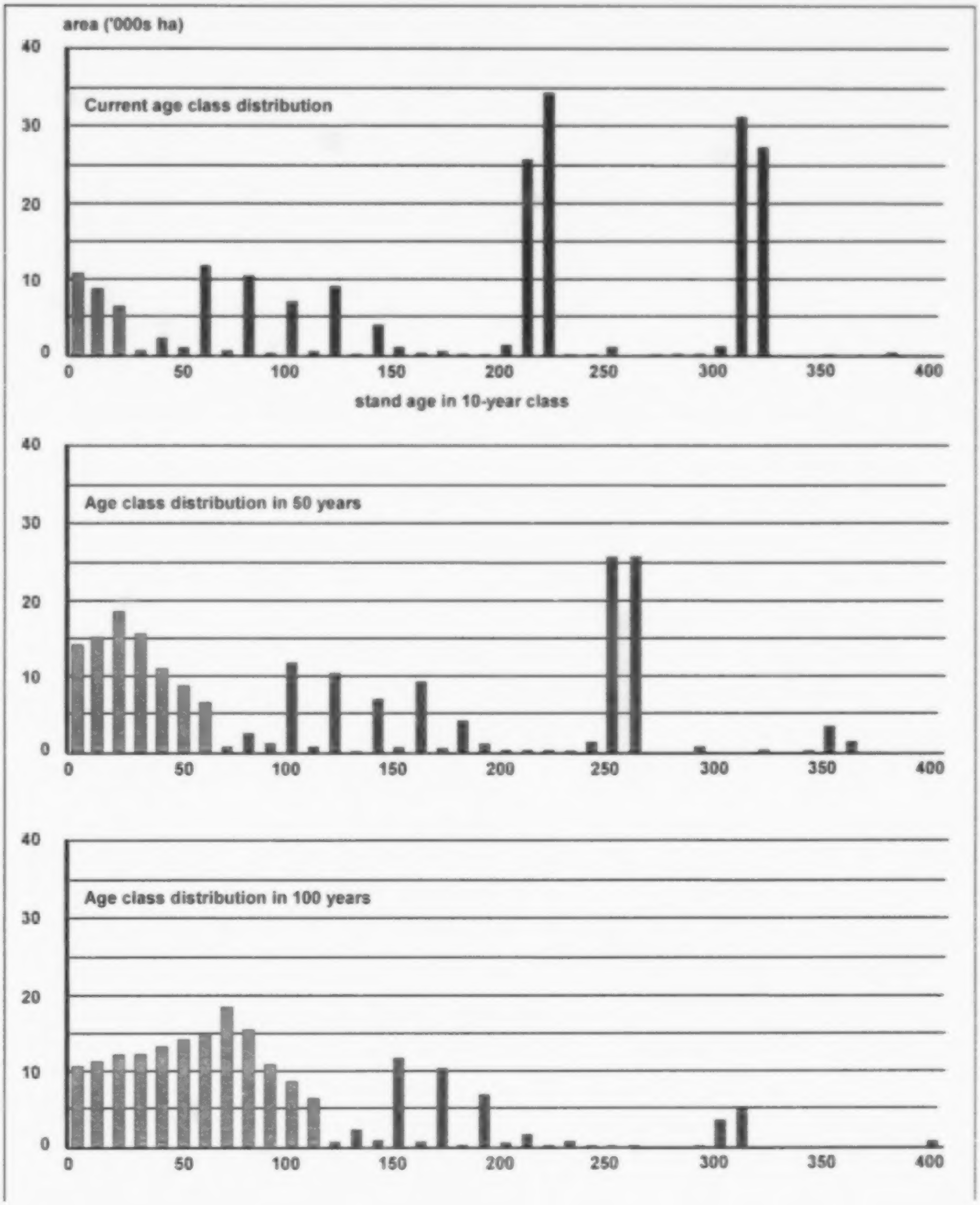

Figure 2.2.7 Stand age distribution projected over time – Robson Valley TSA.

Figure 2.2.7 illustrates that the shape of the timber supply curve is determined largely by the scarcity of mature timber – the main constraining mechanisms are smply the age class distribution and local stand growth rates.

2.4.5.3 RATIONING OF CURRENT MATURE TIMBER

Figure 2.2.8 demonstrates another major factor shaping timber supply – constraints on the rate of change of the harvest level. If the constraint of a maximum of 10% per decade decline is removed, the harvest level could be maintained for 7 decades before collapsing almost to zero in decade 10, and then recovering to the base case long term harvest level by decade 13.

Clearly, the lack of harvestable timber in decades 8-13 has been "filled in" by rationing the current available mature – timber which is currently age 210+ years. Timber rationing is the main objective of constraints on the rate of change of harvest levels. Note that under the base case constraints, any silvicultural activity that produces incremental volume in decades 8-13 releases some of this rationed timber, which in turn releases rationed timber earlier in the harvest queue. This process is a chain reaction allowing timber to substitute back up the falldown steps. Because TSR harvest flow rules will not allow the first decade cut to be increased above TSR if it must subsequently fall, the increment will probably accrue to the second decade. This is the Allowable Cut Effect, in the context of TSR rules.

This second mechanism shaping timber supply – constraints on the rate of change of the harvest level – also provides a means of capturing silvicultural benefits in the short term. Note that the efficacy of this effect is determined by the shape of the timber supply curve and hence is specific to the management unit.

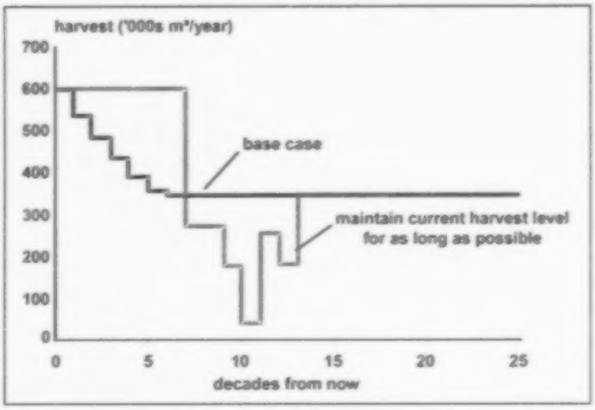

Figure 2.2.8 **Harvest forecast with current harvest maintained as long as possible, Robson Valley TSA.**

2.4.5.4 MINIMUM HARVEST AGES

Minimum harvest ages were set by District staff after review of volume per hectare requirements, culmination ages and field experience. Most minimum harvest ages are set at least 10 years before culmination. Minimum harvest ages might be reduced further through silviculture and the TSR sensitivity analysis Figure 2.2.9 gives us some idea of how much of a timber supply benefit is possible and when it might occur. In the short and early mid term, reducing minimum harvest ages has significant improvement is timber supply. This seems odd as our earlier examination of the forecasted age class distributions indicated that the harvest was supported mainly by stands age >200 years. However, its likely that sometime after decade 10, during the period of maximum scarcity before sufficient managed stands were available to support the cut, the model is harvesting stands at their minimum harvest age. The increase in available stands at this critical point (resulting from reducing minimum harvest age by 20 years) is substituted forward in the harvest queue, up the fall down staircase, drawn by the modelers desire to maintain the initial harvest level for as long as possible and yet still decline at a maximum rate of 10% per decade.

These effects are quantifiable: in the short term (second decade), reducing the minimum harvest age by 20 years produces a benefit of 60,000 m^3. This is based on a harvest rate of 1800 ha per year. So, a silvicultural treatment that reduces minimum harvest age by 20 years produces a benefit of (60 000/1800=) 33 m^3/ha, and a treatment that reduces minimum harvest age by 1 year produces a benefit of (33/20=) 1.65 m^3/ha in decade 2. Using similar logic, in the early mid term (decades 3-6), any treatment that reduces mha by 1 year produces a benefit of ((40 000/1800)/20 =) 1.1 m^3/ha treated.

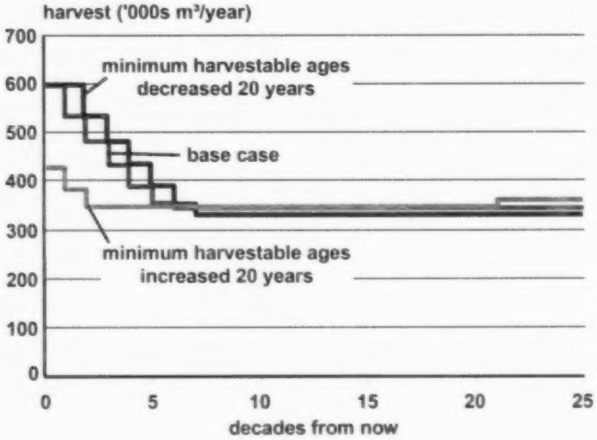

Figure 2.2.9 **Harvest forecast with minimum harvest ages changed by 20 years – Robson Valley TSA.**

Figure 2.2.9 also demonstrates that the harvest flow constraint mechanism for bringing benefits forward also works in reverse if there is a increase in scarcity at the critical period (pinch point) in supply. If minimum harvestable ages increase by 20 years, the period of scarcity is deepened and lengthened, and much more of the remaining mature timber must be held in order to sustain the cut at the long term harvest level. In this case , the short-term and early mid-term reduction in supply resulting from increased minimum harvest age is much larger in magnitude than the short-term and early mid-term increases that would occur if the minimum harvest ages were decreased.

Note that in the TSR sensitivity analysis, the change in harvest ages is applied to all stands across the 250 year modelling horizon, while we would be applying silviculture treatments to specific inventory targets and might expect larger benefits.

2.4.5.5 GREEN-UP

The TSR sensitivity analysis for green-up (Figure 2.2.10) provides us with similar results. A 10 year decrease in green-up results in benefits across the entire planing horizon, but the short-term and early mid-term benefits are much larger than the long term benefits. The same mechanism that was described for minimum harvest ages also applies here – at the time of real physical shortage (decades 7-15), reduction of the green-up ages by 10 years frees up harvestable stands, and the benefits forward substitute back up the fall down staircase. The sensitivity coefficients can be calculated using the same logic as for minimum harvest ages. In the short term, reducing green-up age by 1 year produces 3.3 m3 per hectare treated; in the early mid term, the benefit is 2.2 m3 per hectare treated, and in the later mid term and long term, the benefit is 0.6 m3 per hectare treated. The assumptions for this and subsequent calculations can be found in the summary table at the end of this section.

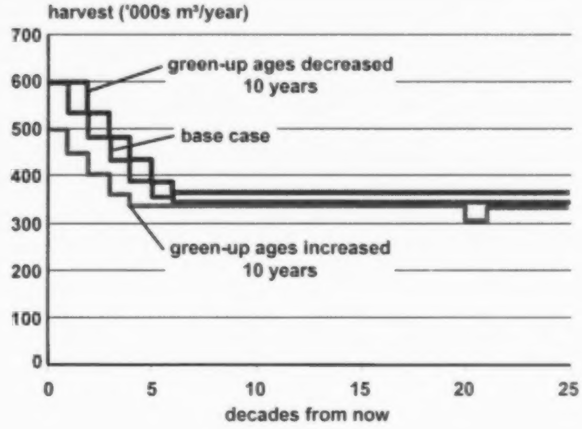

Figure 2.2.10 Harvest forecast with green-up ages changed by 10 years – Robson Valley TSA.

Increasing green-up age results in a large reduction in short and early mid-term timber supply. The reason for this is similar to that for increasing minimum harvest ages. That is, the increased green-up age causes the period of real physical scarcity to broaden and deepen, and more of the existing stock of mature timber must be rationed to maintain the harvest at the long term harvest level.

2.4.5.6 INCREASING STAND YIELDS

Increasing existing stand yields has a substantial effect on short- and mid-term timber supply (Figure 2.2.11). Again, the late mid term scarcity and forward substitution effect allows a disproportionate benefit to be realized in the earlier decades. Increasing regenerated volumes has no effect in the short or mid-term. The sensitivity coefficients for these two effects are included in the summary table at the end of this section.

2.4.5.7 INCREASING THE TIMBER HARVESTING LAND BASE

Various silvicultural activities can be interpreted as bringing land into the timber harvesting land base and so the TSR sensitivity analyses of the effect of increasing the timber harvesting land base (Figure 2.2.12) will provide information on the magnitude and timing of the benefits. Increasing the timber harvesting land base increases timber supply across the whole planning horizon and the sensitivity coefficients for this effect is included in the summary table at the end of this section.

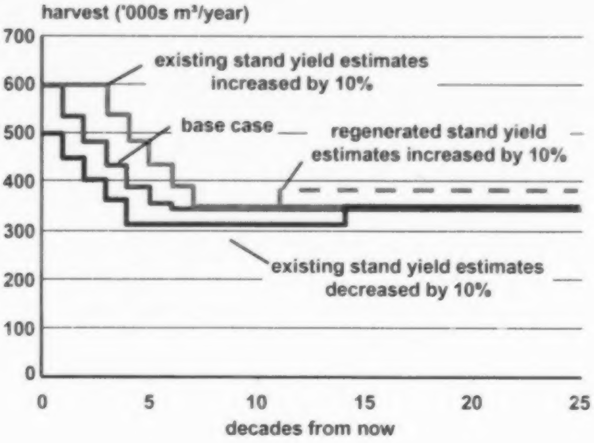

Figure 2.2.11 **Harvest forecasts with existing and regenerated stand yield estimates increased by 10%**

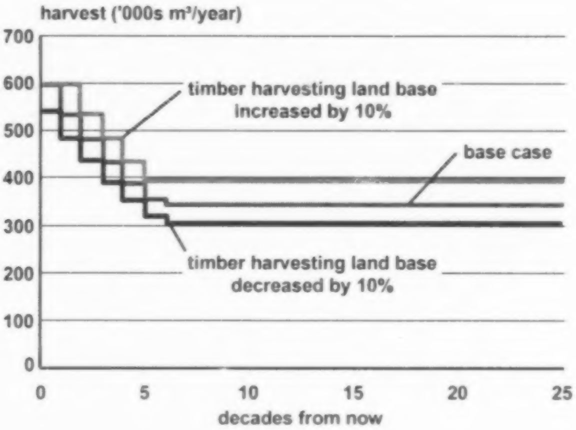

Figure 2.2.12 **Harvest forecasts with the area of the timber harvesting land base increased and decreased by 10%.**

2.4.6 TIMBER SUPPLY DYNAMICS - SUMMARY

The main constraint on timber supply in the Robson Valley TSA is the physical scarcity of harvestable timber in the late mid-term. This scarcity requires that the substantial volumes of existing mature timber from unmanaged stands be rationed until managed stands are ready for harvest. The rationing mechanism (TSR harvest flow constraints) can also be used to convey back to the short- and early mid-term the future timber supply benefits resulting from manipulating forest-level parameters. Silvicultural practices that adjust green-up ages, minimum harvest ages, stand yields, and the extent of timber harvesting land base will have significant effect on timber supply and those effects are quantified as sensitivity coefficients in Table 2.2.6.

However, the same mechanism works in reverse if timber supply is reduced at the period of physical scarcity. Currently mature and available timber must be pulled backward in the harvest queue (rationed) to offset the reduction in available supply in the critical period. Short- and mid-term reductions due to increases in minimum harvest ages and green-up ages are disproportionately large relative to the timber supply benefits accruing to those time periods from reducing minimum harvest ages and green-up ages.

Table 2.2.6 Sensitivity coefficients relating forest-level factors to timber supply.

Forest Level Factors	Term	Gross Benefit (m3/ha)	Area Harvested (ha)	Change (years)	Sensitivity Coefficient[1]
Greenup Age (years)	Short	60,000	1800	-10	3.3
	Mid	40,000	1800	-10	2.2
	Long	10,000	1800	-10	0.6
Minimum Harvest Age (years)	Short	60,000	1800	-20	1.7
	Mid	40,000	1800	-20	1.1
THLB age< greenup (%)	Short	60,000	1800	-5	6.7
	Mid	40,000	1800	-5	4.4
	Long	10,000	1800	-5	1.1
existing stand yields (%)	Short	70,000	1800	10	3.9
	Mid	82,000	1800	10	4.6
regenerated stand yields (%)	Long	42,000	1800	10	2.3
timber harvesting land base (%)	Short	60,000	1800	10	3.3
	Mid	47,000	1800	10	2.6
	Long	50,000	1800	10	2.8
[1] m^3/ha treated per unit reduction					

2.4.7 KEY ISSUES AND POTENTIAL SILVICULTURAL STRATEGIES

This section identifies the key Sustainable Harvest issues facing the TSA, as well as potential silvicultural strategies considered suitable to address them. Of those resource supply issues described in Section 2.2.2, three were considered key by stakeholders:

- Severe decline in short, medium and long-term timber supply.
- White pine blister rust losses
- Potentially declining local timber quality

Potential silvicultural strategies are those silvicultural interventions having potential to either maintain or increase future timber supply at the TSA level. Those strategies considered feasible and desireable by Robson Valley stakeholders are listed in Table 2.2.7. This set of strategies must be considered provisional at this time; they must be further evaluated during Type II Silvicultural Analyses currently underway. Local technical expertise, current policies and present uncertainties surrounding some strategies are reflected in SH investment recommendations.

The identity of each silvicultural strategy in Table 2.2.7 conveys the expected time of timber supply response (S-short term, M-medium term, and L-long term), or whether the strategy is timber quality oriented (Q), or designed to address forest health (FH) issues.

Figure 2.2.13 illustrates the timber supply responses of the strategies identified in Table 2.2.7. Strategy S3, reducing the minimum harvestable age by spacing younger existing stands, targets the pinch point in timber supply identified in section 2.4.3. Short term timber supply is sensitive to reductions in minimum harvestable age due to the forward substitution. Attaining green-up at an earlier age (S4) releases adjacent timber for harvesting in the short term. Maintaining the timber harvesting land base by meeting the backlog reforestation assumptions of the TSR (L1) benefits timber supply in the long term, as does increasing the yield of regenerated stands.

Table 2.2.7 Potential silvicultural strategies, tactics, target stands and stakeholder priority for mitigating key Robson Valley TSA resource supply issues.

Issue	Silvicultural Strategy	Silvicultural Tactics	Target Stands	Rank
Declining short, medium and long term timber supply	**S3** Reduce minimum harvestable ages by 10 years	precommercial thinning (juvenile spacing)	pine existing stands, ages 15-30, >3000 sph	5
		precommercial thinning	spruce existing stands, ages 15-30, >3000 sph	6
	L3 Increase the volume of regenerated stands by 20%	repeat fertilization, 15year cycle	regen, all; Pl, Fd, sites: (lower 1/4G, M, upper 1/4P)	nr
		repeat fertilization, 15year cycle	Pl, Fd, sites: (lower 1/4G, M, upper 1/4P), East Canoe, <2000 sph	7
	L1 Maintain the timber harvesting land base	survey	pre-87 backlog SR impeded	1
		brush		2
		site prep	pre-87 backlog	3
		plant		3
Pest losses to juvenile white pine	**FH1** Prune to reduce risk of infection	Infected branch pruning	Fdi, Pl, Pw stands (Pw priority; Fdi and Pl mixed in)	4
Declining timber quality	**Q1** Clearwood prujning	Branch pruning	Fdi, Pl	8

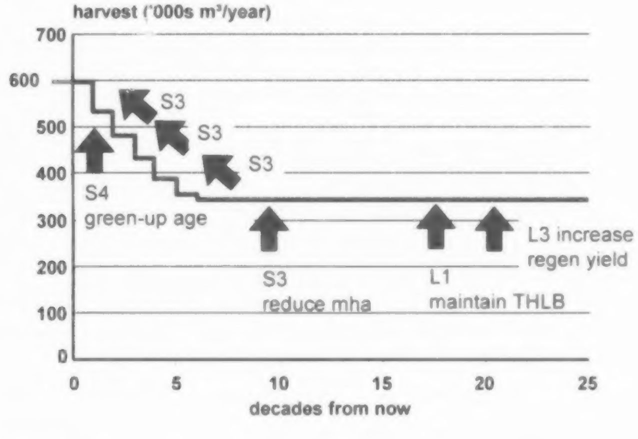

Figure 2.2.13. Location of timber supply effects of the selected strategies.

Table 2.2.8 Silviculture tactics, the strategies they implement, their impacts on TSA objectives, and their overall TSA priorities.

Issue	Silvicultural Strategy	Silvicultural Tactics	Target Stands	Opportunity	Timber Supply Effects				Habitat	Jobs	Cost
				Area (Ha/Yr)	Short	Medium	Long	Quality		Days/ha	$/ha[1]
Declining timber supply	Maintain the timber harvesting land base	Surveys - general		1355						0.1	23
		Survey - prescription	SR impeded backlog	4000						0.1	20
		Site prep backlog	NSR	50		M	M		-	1.0	900
		Plant backlog	NSR	50		M	M		-	1.3	800
	Reduce green-up ages by 10 years	Brush impeded	SR	400		M	M		-	2.0	900
	Reduce minimum harvestable ages by 10 years	Precommercial thin	Pl existing stands, ages 15-30, >3000 sph	100	+ +	+	-		+ +	3.0	1200
			Sx existing stands, ages 15-30, >3000 sph	100	+ +	+	-		+	3.0	1200
	Increase the volume of regenerated stands by 20%	Fertilize, repeat 15 year cylce	Pl, Fd, sites: (lower 1/4G, M, upper 1/4P), East Canoe, <2000 sph	400 (5 years only)	+ +	+			+/-	0.1	250
			Pl, Fd, sites: (lower 1/4G, M, upper 1/4P), <2000 sph	0 (up to 1 100 in short term)		+	+		+/-	0.1	250
White pine losses	Prune to reduce risk of infection	Prune	Fdi, Pl, Pw stands (Pw priority; Fdi and Pl mixed)	75	+ +	+		+		1.0	300
Declining timber quality	Clearwood prujning		Fdi, Pl	200				+		4.0	1200

+, - indicates, respectively, a positive or negative impact on the indicated objective.

+/- indicates that the activity could have a positive or negative effect, depending on its circumstances of application

M necessary to maintain the TSR; TSR assumption

nr not ranked

Tactic 1, general surveys, is estimated to be three times the annual total program level.

Tactic 3, site preparation of backlog NSR, will not begin until 2001.

Tactic 8, fertilization of East Canoe sites: the opportunity area of 400 ha/year will be exhausted in 5 years.

Tactic 8, East Canoe sites consist of old beetle salvage

Tactic 9, fertilization: there is no opportunity in the next five years to implement this regime but the workshop determined that the program could reach a level of 1100 ha per year in the long run.

2.4.7.1 TACTICAL PRIORITIES

The priority rankings of Table 2.2.8 represent a balance between the TSA strategic concerns and the silvicultural opportunities available on the TSA in the next 5 years.

After surveys, which are necessary precursors to the remainder of the program, the highest ranked tactics are the silvicultural treatments of backlog NSR, which implement strategy L1 (maintenance of the timber harvesting land base as represented in the TSR).

The next tactical priority was pruning of the Pw components of mixed Fdi, Pl, Pw stands, which implements the forest health strategy FH1, pruning to reduce risk of infection, and strategy L3, increasing regenerated stand yields.

Note that strategy L3 actually provides multiple forest benefits. Application of this regime to young existing stands is expected to reduce the minimum harvestable ages of timber available for harvest (designate as S3 in Figure 2.2.13) and increase the supply of harvestable timber at a point of scarcity (pinch point) in the late mid-term. The timber supply benefits are expected to accrue to the short term. The fertilization component of this regime will accelerate green-up (designated S4 in Figure 2.2.13), also increasing timber supply in the short term.

Applied to both current and future stands, fertilization will increase long-term timber supply by increasing stand yields, designated L3 in the Figure.

The next tactical priority was precommercial thinning existing Pl and Sx stands, to implement S3, the strategy of reducing minimum harvestable age. The last priority is Pruning for clear wood values Q1

2.4.7.2 RECOMMENDED KNOWLEDGE STRATEGIES

There are many related TSA silvicultural issues not directly addressable via silvicultural practices. Many of these require investigation and further study. Table 2.2.9 identifies, and ranks the importance of 10 Sustainable Harvest knowledge gap issues. The reader is directed to Volume 4 of this RMP, which documents a comprehensive analysis of SSFM knowledge strategies and tactics. Many of the issues in Table 2.2.9 are incorporated into this analysis.

Table 2.2.9 Silviculture issues requiring study.

Sustainable Harvest Knowledge Gap Issue	Priority
Confirm or refine site productivity estimates for the TSA.	1
Develop a growth and yield monitoring strategy (including the effects of leader weevil and root collar weevil).	2
Review the green-up ages used in the TSR and clarify how they were derived. Confirmation of these green-up ages may require a sampling project.	3
Confirm or refine the OAF1 estimates of the TSR with OAF1 surveys	4
Establish spruce fertilization trials, emphasizing both late rotation and early fertilization regimes.	5
Support and participate in the caribou high trials.	6
Post TSR2, investigate opportunities on non-merch and low sites.	7
Evaluate the need and opportunity for Pw pruning.	7
Establish fertilization trials in Pl age 30-50	8
Establish spruce pruning trials and determine if timing is a factor in success or failure.	9

2.4.8 MANAGEMENT UNIT SUSTAINABLE HARVEST PLAN – 2002-2007

2.4.8.1 ENHANCED FORESTRY PROGRAM

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	1000	1000	100	100	100	33.00	33000	
Spacing	50	50	50	50	50	950.00	47500	
Pruning	20	0	0	0	0	1200.00	24000	
Fertilizing	0	0	0	0	0	0.00	0	
Other	0	0	0	0	0	0.00	0	
Totals hectares	1070	1050	150	150	150	97.66	104,500	
Planning and prescriptions							7,500	
Total dollars							112,000	

Forest Health Enhancement

Spacing	0	0	0	0	0	0.00	0
Pruning	0	0	0	0	0	0.00	0
Other treatments	0	0	0	0	0	0.00	0
Totals hectares	0	0	0	0	0	0.00	0

Habitat Supply and Biodiversity Enhancement

Riparian treatments	0	0	0	0	0	0.00	0
Non-riparian treatments	0	0	0	0	0	0.00	0
Totals hectares	0	0	0	0	0	0.00	0

Domestic Range

Treatments	0	0	0	0	0	0.00	0

Enhanced Forestry Activities - Management Unit Total

Surveys	1000	1000	100	100	100	33.00	33,000
Spacing	50	50	50	50	50	949.98	47,500
Pruning	20	0	0	0	0	1,199.94	24,000
Fertilizing	0	0	0	0	0	0.00	0
Other stand tending activities	0	0	0	0	0	0.00	0
Totals hectares	1070	1050	150	150	150	97.66	104,500
Planning and prescriptions							7,500
Studies funding							0
Total dollars							112,000

2.4.8.2 BACKLOG FORESTRY PROGRAM

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Legal Obligations	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	30	50	50	50	0.00	0	
Site preparation	0	0	0	0	0	0.00	0	
Planting	0	0	30	50	50	0.00	0	
Brushing	0	0	0	30	50	0.00	0	
Max. density spacing	0	0	0	0	0	0.00	0	
Totals hectares	0	30	80	130	150	0.00	0	
Seed purchase	0	0	0	0	0	0.00	0	
Total legal obligations							0	
Backlog Reforestation								
Surveys	200	100	50	0	0	25.00	5000	
Site preparation	150	50	50	50	50	800.00	120000	
Planting	40	150	50	50	50	450.00	18000	
Brushing	40	85	50	50	50	1,000.00	40000	
Totals hectares	430	385	200	150	150	425.58	183,000	
Seed purchase	40	150	50	50	50	306.25	12,250	
Prescriptions and planning dollars							18,300	
Total backlog reforestation							213,550	
Impeded areas								
Surveys	3000	2100	1800	1000	700	25.00	75000	
Brushing	400	300	200	200	200	1,000.00	400000	
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	3400	2400	2000	1200	900	139.71	475,000	
Prescriptions and planning dollars							47,500	
Total impeded areas							522,500	
Site Restoration								
Fill planting	30	30	30	30	30	450.00	13500	
Rehabilitation	30	30	30	30	30	550.00	16500	
Reforestation	0	0	0	0	0	0.00	0	
Totals hectares	60	60	60	60	60	499.99	30,000	
Seed purchase	30	0	0	0	0	280.00	8,400	
Prescriptions and planning dollars							3,000	
Total site restoration							41,400	
Backlog Program Activities - Management Unit Total								
Surveys	3200	2230	1900	1050	750	25.00	80000	
Site preparation	180	80	80	80	80	758.33	136500	
Planting	70	180	110	130	130	449.99	31500	
Brushing	440	385	250	280	300	1,000.00	440000	
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	3890	2875	2340	1540	1260	176.86	688000	
Seed purchase	70	150	50	50	50	295.00	20650	
Prescriptions and planning							68,800	
Recommended studies							0	
Total backlog program							777,450	

2.4.8.3 MANAGEMENT UNIT FRBC PERFORMANCE TABLE

	Performance Measure	Tree Improvement	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
	Inputs											
A	**Planned treatment area (ha) in 2002/2003**	1,138	1,138	4,100	180	70	440	50	20	0	7,136	
1.0	**Timber Supply**											
1.1	Potential volume/ha gain (m3/ha/yr)	0.41	0	0	0	2.9	0.41	0.25	0	0.40		
1.2	Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3	Pot. total merch. volume increment in 65 years (m3)	30,328	0	0	0	13,377	11,726	813	0	0		**56,244**
1.4	Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4	Est. area that will be reclassified as stocked (ha)			50								**50**
1.5	Est. area that will be declared as free growing (ha)			1,800								**1,800**
2.0	**Wood Value**											
2.1	Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0	**Employment**											
3.1	Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	1	2.8	3.96	4.54	0.18	0.1	
3.2	Estimated total employment (person days/year)	114	387	410	171	70	1,232	198	91	0	714	
3.3	Estimated total full time equivalent positions (FTE)	1	2	2	1	0	7	1	1	0	4	**19**
4.1	**Forest Health Enhancement (ha)**											**0**
5.1	**Habitat Supply**											
5.2	Planned area for specific wildlife forage or habitat maintenance in 2002/2003 (ha)											**0**
5.3	Est. area with secondary value provided to biodiversity (ha)											**0**

2.4.8.4 MANAGEMENT UNIT SUMMARY TABLE

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	1,070	1,050	150	150	150	98	104,500
Planning, prescriptions and seedlings							7,500
Backlog Program Field Activities	3,890	0	0	0	0	177	688,000
Planning, prescriptions and seedlings							89,450
Totals	4,960	1,050	150	150	150		889,450

Performance Measures

Potential total merchentable volume increment in 65 years	56,244 m^3
Estimated ha that will be reclassified as stocked	50 ha
Estimated ha that will be declared as free growing	1,800 ha
Estimated total full time equivalent positions generated	19 FTEs
Forest health enhancement area	0 ha
Planned area for specific wildlife forage or habitat maintenance	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

2.5 MACKENZIE TSA SUSTAINABLE HARVEST ISSUES AND SILVICULTURAL STRATEGY

During the 2000/01 RMP process there was concern in the Mackenzie Forest District that the RMP and investment plan did not adequately reflect the priorities that had been developed by the District Stakeholder Group. Consequently there was a discrepancy between Licensee work plans and the Regional Investment Plan, particularly in the level of investment allocated to each of Forest Renewal BC's forest and environment strategic objectives (EEV, SH and SSFM). A potential solution to this problem was to conduct a pilot RMP process whereby district stakeholders were involved in the allocation of funding among the strategic objectives.

Employing a new, pilot RMP process, the Mackenzie Sustainable Resource Management Plan (MSRMP) incorporates local issues and priorities into a five-year strategic planning framework. The new process includes a set of guiding principles, a detailed process outlining the steps for completing a strategic resource management plan and a description of roles and responsibilities. The process has, following substantial discussion and negotiation, resulted in a stand-alone strategic resource management plan for the Mackenzie Forest District. As such, its strategic priorities and activity plans are intended to be reflected in the regional investment plan and the complete MSRMP will be appended to the regional investment plan. While the Mackenzie RMP will not be modified or changed to fit the conventional regional format., the Sustainable Harvest elements have been excerpted and included in this section as Enhanced and Backlog tables.

The reader is encouraged to review the MSRMP in its entirety (Volume 2 Appendix) in order to understand the context of the following tabular summaries, as well as the successful pilot process it represents..

2.5.1 MANAGEMENT UNIT SUSTAINABLE HARVEST ACTIVITIES – 2002-2007

2.5.1.1 ENHANCED FORESTRY ACTIVITIES (FROM THE MACKENZIE SUSTAINABLE RESOURCE MANAGEMENT PLAN)

Activities	**Treatment Area Goals (ha)**					**Plan 2002/03**		
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	0	0	0	0	0.00	0	
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	0	0	0	0	0	0.00	0	
Other	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Planning and prescriptions							0	
Total dollars							0	
Forest Health Enhancement								
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Other treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Habitat Supply and Biodiversity Enhancement								
Riparian treatments	0	0	0	0	0	0.00	0	
Non-riparian treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Domestic Range								
Treatments	0	0	0	0	0	0.00	0	
Enhanced Forestry Activities - Management Unit Total								
Surveys	0	0	0	0	0	0.00	0	
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	0	0	0	0	0	0.00	0	
Other stand tending activities	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Planning and prescriptions							0	
Studies funding							0	
Total dollars							0	

2.5.1.2 MACKENZIE TSA WOODLOTS ENHANCED FORESTRY ACTIVITIES

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	0	0	0	0	0.00	0	
Spacing	23	0	0	0	0	1000.00	23000	
Pruning	7	0	0	0	0	1000.00	7000	
Fertilizing	0	0	0	0	0	0.00	0	
Other	0	0	0	0	0	0.00	0	
Totals hectares	30	0	0	0	0	999.90	30,000	
Planning and prescriptions							3,660	
Total dollars							33,660	
Forest Health Enhancement								
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Other treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Habitat Supply and Biodiversity Enhancement								
Riparian treatments	0	0	0	0	0	0.00	0	
Non-riparian treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Domestic Range								
Treatments	0	0	0	0	0	0.00	0	
Enhanced Forestry Activities - Management Unit Total								
Surveys	0	0	0	0	0	0.00	0	
Spacing	23	0	0	0	0	999.96	23,000	
Pruning	7	0	0	0	0	999.86	7,000	
Fertilizing	0	0	0	0	0	0.00	0	
Other stand tending activities	0	0	0	0	0	0.00	0	
Totals hectares	30	0	0	0	0	999.70	30,000	
Planning and prescriptions							3,660	
Studies funding							0	
Total dollars							33,660	

2.5.1.3 BACKLOG FORESTRY ACTIVITIES (FROM THE MACKENZIE SUSTAINABLE RESOURCE MANAGEMENT PLAN)

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Legal Obligations	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	750	1500	2875	2750	0	40.00	30000	
Site preparation	0	0	0	0	0	0.00	0	
Planting	50	0	0	0	0	700.00	35000	
Brushing	830	550	500	450	10	795.18	660000	
Max. density spacing	0	0	0	0	0	0.00	0	
Totals hectares	1630	2050	3375	3200	10	444.78	725,000	
Seed purchase	50	0	0	0	0	200.00	10000	
Total legal obligations							735,000	
Backlog Reforestation								
Surveys	0	0	0	0	0	0.00	0	
Site preparation	0	0	0	0	0	0.00	0	
Planting	0	0	0	0	0	0.00	0	
Brushing	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Seed purchase	0	0	0	0	0	0.00	0	
Prescriptions and planning dollars							0	
Total backlog reforestation							0	
Impeded areas								
Surveys	1833	1000	900	200	200	30.01	55000	
Brushing	0	0	0	0	0	0.00	0	
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	1833	1000	900	200	200	30.01	55,000	
Prescriptions and planning dollars							75,000	
Total impeded areas							130,000	
Site Restoration								
Fill planting	0	0	0	0	0	0.00	0	
Rehabilitation	0	0	0	0	0	0.00	0	
Reforestation	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Seed purchase	0	0	0	0	0	0.00	0	
Prescriptions and planning dollars							0	
Total site restoration							0	
Backlog Program Activities - Management Unit Total								
Surveys	2583	2500	3775	2950	200	32.91	85000	
Site preparation	0	0	0	0	0	0.00	0	
Planting	50	0	0	0	0	699.96	35000	
Brushing	830	550	500	450	10	795.18	660000	
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	3463	3050	4275	3400	210	225.24	780000	
Seed purchase	50	0	0	0	0	199.99	10000	
Prescriptions and planning							75,000	
Recommended studies							0	
Total backlog program							865,000	

2.5.1.4 MACKENZIE TSA WOODLOTS BACKLOG FORESTRY ACTIVITIES

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Legal Obligations	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	0	0	0	0	0.00	0	
Site preparation	0	0	0	0	0	0.00	0	
Planting	0	0	0	0	0	0.00	0	
Brushing	0	0	0	0	0	0.00	0	
Max. density spacing	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Seed purchase	0	0	0	0	0	0.00	0	
Total legal obligations							0	
Backlog Reforestation								
Surveys	155	0	0	0	0	64.20	9951	
Site preparation	58	0	0	0	0	1,210.66	70218	
Planting	58	0	0	0	0	565.83	32818	
Brushing	51	0	0	0	0	1,059.61	54040	
Totals hectares	322	0	0	0	0	518.72	167,027	
Seed purchase	0	0	0	0	0	0.00	0	
Prescriptions and planning dollars							0	
Total backlog reforestation							167,027	
Impeded areas								
Surveys	0	0	0	0	0	0.00	0	
Brushing	0	0	0	0	0	0.00	0	
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Prescriptions and planning dollars							0	
Total impeded areas							0	
Site Restoration								
Fill planting	0	0	0	0	0	0.00	0	
Rehabilitation	0	0	0	0	0	0.00	0	
Reforestation	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Seed purchase	0	0	0	0	0	0.00	0	
Prescriptions and planning dollars							0	
Total site restoration							0	
Backlog Program Activities - Management Unit Total								
Surveys	155	0	0	0	0	64.20	9951	
Site preparation	58	0	0	0	0	1,210.61	70218	
Planting	58	0	0	0	0	565.80	32818	
Brushing	51	0	0	0	0	1,059.57	54040	
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	322	0	0	0	0	518.70	167027	
Seed purchase	0	0	0	0	0	0.00	0	
Prescriptions and planning							0	
Recommended studies							0	
Total backlog program							167,027	

2.5.2 MANAGEMENT UNIT FRBC COMPONENT PERFORMANCE TABLES

2.5.2.1 MACKENZIE SUSTAINABLE RESOURCE MANAGEMENT PLAN ACTIVITIES

Performance Measure	Tree Improve-ment	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
Inputs											
A **Planned treatment area (ha) in 2002/2003**	50	0	1,300	0	50	830	0	0	0	2,230	
1.0 **Timber Supply**											
1.1 Potential volume/ha gain (m3/ha/yr)	0.41	0	0	0	2.9	0.41	0.25	0	0.40		
1.2 Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3 Pot. total merch. volume increment in 65 years (m3)	1,333	0	0	0	9,556	22,120	0	0	0		33,008
1.4 Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4 Est. area that will be reclassified as stocked (ha)			325								325
1.5 Est. area that will be declared as free growing (ha)			260								260
2.0 **Wood Value**											
2.1 Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0 **Employment**											
3.1 Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	2	2.61	3.96	4.54	0.18	0.1	
3.2 Estimated total employment (person days/year)	5	0	130	0	100	2,166	0	0	0	223	
3.3 Estimated total full time equivalent positions (FTE)	0	0	1	0	1	12	0	0	0	1	15
4.1 **Forest Health Enhancement (ha)**											0
5.1 **Habitat Supply**											
5.2 Planned area for specific wildlife forage or habitat maintenance in 2002/2003 (ha)											0
5.3 Est. area with secondary value provided to biodiversity (ha)											0

2.5.2.2 MACKENZIE TSA WOODLOT ACTIVITIES

Performance Measure	Tree Improvement	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
Inputs											
A **Planned treatment area (ha) in 2002/2003**	58	0	78	58	58	51	23	7	0	333	
1.0 **Timber Supply**											
1.1 Potential volume/ha gain (m3/ha/yr)	0.41	0	0	0	2.9	0.41	0.25	0	0.40		
1.2 Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3 Pot. total merch. volume increment in 65 years (m3)	1,546	0	0	0	11,084	1,359	374	0	0		**14,363**
1.4 Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4 Est. area that will be reclassified as stocked (ha)			20								**20**
1.5 Est. area that will be declared as free growing (ha)			16								**16**
2.0 **Wood Value**											
2.1 Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0 **Employment**											
3.1 Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	2	2.61	3.96	4.54	0.18	0.1	
3.2 Estimated total employment (person days/year)	6	0	8	55	116	133	91	32	0	33	
3.3 Estimated total full time equivalent positions (FTE)	0	0	0	0	1	1	1	0	0	0	**3**
4.1 **Forest Health Enhancement (ha)**											**0**
5.1 **Habitat Supply**											
5.2 Planned area for specific wildlife forage or habitat maintenance in 2002/2003 (ha)											**0**
5.3 Est. area with secondary value provided to biodiversity (ha)											**0**

2.5.2.3 MACKENZIE SUSTAINABLE RESOURCE MANAGEMENT PLAN ACTITIES

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	0	0	0	0	0	0	0
Planning, prescriptions and seedlings							0
Backlog Program Field Activities	3,463	0	0	0	0	225	780,000
Planning, prescriptions and seedlings							85,000
Totals	3,463	0	0	0	0		865,000

Performance Measures	
Potential total merchentable volume increment in 65 years	33,008 m^3
Estimated ha that will be reclassified as stocked	325 ha
Estimated ha that will be declared as free growing	260 ha
Estimated total full time equivalent positions generated	15 FTEs
Forest health enhancement area	0 ha
Planned area for specific wildlife forage or habitat maintenance	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

2.5.2.4 MACKENZIE TSA WOODLOT ACTIVITIES

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	30	0	0	0	0	1,000	30,000
Planning, prescriptions and seedlings							3,660
Backlog Program Field Activities	322	0	0	0	0	519	167,027
Planning, prescriptions and seedlings							0
Totals	352	0	0	0	0		200,687

Performance Measures

Potential total merchentable volume increment in 65 years	14,363 m^3
Estimated ha that will be reclassified as stocked	20 ha
Estimated ha that will be declared as free growing	16 ha
Estimated total full time equivalent positions generated	3 FTEs
Forest health enhancement area	0 ha
Planned area for specific wildlife forage or habitat maintenance	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

2.6 DAWSON CREEK TSA SUSTAINABLE HARVEST ISSUES AND SILVICULTURAL STRATEGY

This section describes the key sustainable harvest issues in the Dawson Creek TSA, and defines a provisional silvicultural strategy to address them. The following strategic analysis is based on a recently completed Type I Silvicultural Analysis, but requires further, detailed forest analysis and modelling in the Type II analysis. In the meantime, this provisional strategy is reflected in the proposed, 5 year Sustainable Harvest Plan for the Dawson Creek Forest District (Section 2.8).

2.6.1 THE RESOURCE LAND BASE

The Dawson Creek TSA covers 2 277 753 hectares, of which 811 662 (36%) is considered to be in the timber harvesting land base.

The site class profile of the timber harvesting land base is: 45% poor, 43% medium and 12% good site.

In Figure 2.4.1, old refers to deciduous and stands dominated by pine, which are older than 80 years. For all other species old refers to stands which are older than 100 years. Older stands account for 54% of the timber harvesting land base, while 46% is accounted for by younger stands. Sites categorized as good account for 12% of the timber harvesting land base, while medium sites account for 45%, and poor sites account for 43%. A majority of the forest which will be harvested in the short term will be coming from spruce and balsam sites with poor site quality

Mature pine stands less than 19.5 metres have been separated from other pine stands in the analysis because these stands will not yield a log of merchantable length. Since these stands are separated they can be tracked throughout the models planning horizon.

2.6.2 RESOURCE SUPPLY ISSUES

2.6.2.1 TIMBER SUPPLY – VOLUME

Resource Inventory and Growth and Yield Information - The present forest resource inventory is out of date, and there is considerable uncertainty regarding its accuracy and reliability. Specifically, there are insufficient Phase II VRI sampling by strata, lack of Phase I VRI; unreliable representation of forest attributes for establishing legal objectives for landscape units; unreliable volume estimates for expected rates of growth (especially for the small pine partitioned harvest). This uncertainty, in turn, confounds attempts to define measurable resource management objectives, and prevents development of a soundly based silvicultural strategy

There are presently no satisfactory estimates of future productivity from residual subalpine fir in spruce-overstorey removal shelterwoods. This uncertainty hinders projection of future yields, and makes it difficult to evaluate the suitability of the advance regeneration on these sites. Approximately 13% of the TSA harvest comes from this forest type, yet there are currently no suitable yield projection models for these stands.

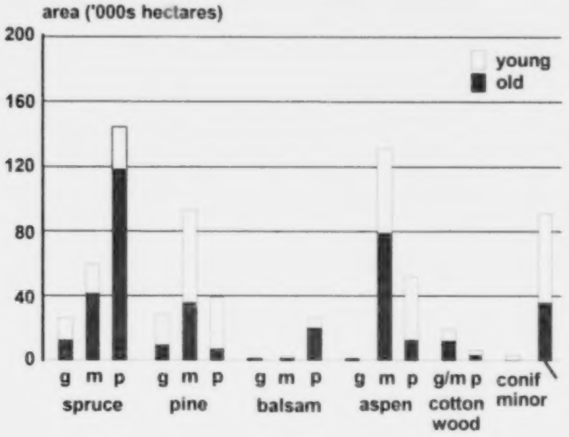

Figure 2.4.1 **Area of dominant tree species, quality of site, and maturity of stand in the timber harvesting land base, Dawson Creek TSA 1994**

There is also uncertainty regarding the actual productivity potential for all stands in the TSA, particularly current and backlog managed stands, deciduous and complex. The Old Growth Site Index (OGSI) project suggests that site productivity may be underestimated for regenerating stands. Current estimates for complex stands (e.g., mixedwoods) are also known to be unreliable. Current volume estimates and yield projections do not represent local stand dynamics. Timber supply implications relating to deciduous/coniferous land base, silviculture obligations, and seral distribution at the landscape level.

Pre-'87 Backlog Status - A key sustainable harvest issue in the Dawson Creek Forest District is that of ensuring the establishment of commercial conifer and deciduous tree stocking on these sites. Backlog NSR areas must be fully stocked in order to meet TSR assumptions.

Mixedwood Management Objectives - Management objectives and strategies for mixedwood stands are not clear. The dynamics of broadleaf/conifer mixtures in the TSA are not well understood. Most acute is the lack of growth and yield decision support tools for mixed species, which prevents meaningful projection of growth, yield and silvicultural response. A related issue concerns the current management practice of splitting the resource land base into coniferous and deciduous components for determination of allowable annual cut (AAC) and harvest nd other management practices. This frustrates the implementation of sound silvicultural management.

Alternative Silvicultural Systems -The is considerable uncertainty concerning the strategic level impacts of applying silviculture systems other than clear-cutting at the stand level. Stakeholders are unable to incorporate selection and partial cutting silviculture systems in timber supply analyses and landscape unit planning.

2.6.2.2 TIMBER SUPPLY – QUALITY

No studies on timber quality have been completed and no assumptions regarding timber quality were made in the 1994 Timber Supply Review. There are currently no timber quality issues recognised for the TSA.

2.6.2.3 HABITAT SUPPLY

Natural Disturbance Regimes - Seral stage distribution concerns are different east of the Rockies than in the rest of the province. The natural fire disturbance regimes are not being reproduced through implementation of the Forest Practices Code and in many landscape units/BEC subzones. The old forest requirements do not, nor have they ever, existed in the TSA, reflecting the frequent fire disturbance history. This issue affects the supply of habitat for most native species.

Caribou - The NE has terrestrial lichen foraging caribou. Much of the caribou range is being managed through LRMP and TSR provisions. Silvicultural interventions that prolong the usefulness of winter habitat and create new winter habitat should be favoured, although the areal extent of required habitat is not currently known.

Grizzly Bear – There is intense public concern regarding the impact of forestry activities on grizzly bears. This concern exists at the international, national and local levels. Grizzlies are provincially blue-listed and are a species of special concern at the national level. Both the Prince George and Dawson Creek LRMPs provide direction to incorporate the conservation of grizzly bear habitat into forest management activities.

The primary issue concerning grizzly bears is the availability of forage in areas of high grizzly value. Excessive herbicide use destroys the leafy, berry producing trees and shrubs that are used as grizzly forage. This issue may be adequately addressed in Pest Management Plans; otherwise, large reserves of preferred habitat should remain pesticide free.

Additional information on habitat selection by grizzly bears is required to optimize the placement of Wildlife Habitat Areas, and to establish appropriate Landscape Unit objectives for age class, patch size, connectivity and access management that will achieve the conservation of grizzly bear habitat within managed landscapes. Scientifically based conservation measures to protect grizzlies are likely to be a requirement for environmental certification of wood products.

Range Quality – Deciduous regrowth following harvesting of range permit areas may be reducing the quality of primary range.

Non Commercial Cover Conversion - Areas of non-commercial brush (primarily willow and grass) are being converted to spruce plantations. This usually requires the use of herbicides to control vegetation competition. The economic viability of some of these stand conversion treatments is questionable, and there may be some rare ecosystems being impacted. Greater provision of riparian reserves, wildlife tree patches, and seral willow/grass community reserves should be incorporated into stand conversion projects.

2.6.3 SILVICULTURAL PRACTICES

2.6.3.1 INCREMENTAL SILVICULTURAL HISTORY

Table 2.4.1 documents the backlog (pre-'87 openings) silviculture undertaken in the TSA. Only silvicultural activities which took place after 1985 are recorded. Table 2.4.2 documents the current (post '88 openings) silviculture accomplishments to 1999.

Table 2.4.1 Backlog silviculture history 1986-99 , Dawson Creek TSA.

Year	Backlog Site Preparation (ha)	Backlog Planting (ha)	Backlog Brushing (ha)	Backlog Spacing
1986	6189.9	2734.8	77	19
1987	4766	5106	129	51
1988	1141.6	4519.9	454	25
1989	453.3	3403.3	1014	139
1990	207.4	1571.8	1945	
1991	776	1395.7	1190	96
1992	1063	890.1	630	32
1993	593.8	577.4	2456.1	53
1994	292.5	281.5	1513.8	22.8
1995	1620.7	444	1247.3	15.9
1996	16.5	211.7	1170.3	
1997		2	1395.1	11.2
1998		255.7	1030.1	104.2
1999		297.5		
Total	**17120.7**	**21393.9**	**14549.2**	**569.1**

Table 2.4.2 Current silviculture history 1986-99 , Dawson Creek TSA.

Year	Backlog Site Preparation (ha)	Backlog Planting (ha)	Backlog Brushing (ha)	Backlog Spacing
1988	938.8			79
1989	1707.7	855.2		6
1990	2589.1	1838.3	55	116
1991	2376.2	2631.5	907	
1992	4297	2318.8	74.1	
1993	1800.2	3174.6	700.7	
1994	963.4	4141.1	182.3	
1995	799.5	2588.4	701.4	
1996	499.5	2038.4	1464.7	128.2
1997	691	1616.6	1223.5	49.3
1998	269.2	1353.3	843.5	
1999	18.9	490.9	610.5	
Total	**16950.5**	**23047.1**	**6762.7**	**378.5**

2.6.3.2 BACKLOG SILVICULTURE

The area of backlog not satisfactorily restocked land is 15,000 ha, of which 10% will require full stand rehabilitation. Since regeneration surveys conducted prior to 1995 did not consider commercial deciduous species as acceptable stocking on at least 20% of backlog NSR areas, their reported regeneration status is questionable. Acceptance of deciduous stocking on some backlog areas will positively affect deciduous wood supply in the long term.

Additional surveys will be needed to confirm acceptable stocking in backlog NSR areas. Use of herbicides to facilitate conifer crop establishment and to release conifers from brush competition is essential in stand rehabilitation prescriptions. Currently there are no plans to rehabilitate age class 9 balsam stands to pure spruce stands, or to rehabilitate height class 2 pine stands to normal profile pine stands.

2.6.3.3 PRECOMMERCIAL THINNING

Precommercial Thinning (juvenile spacing) has never been a silvicultural priority in the Dawson Creek TSA, as the historical figures in Tables 2.4.1 and 2 indicate. When prescribed, the conventional thinning regimes identified in Table 2.4.3 are implemented.

Table 2.4.3 Precommercial thinning regimes, Dawson Creek TSA

Species	Spaced From (stems/ha)	Residual Density (stems/ha)
At	2000-5000	2500
At	>13000	2500
Pl	2000-10000	1200
Pl	>25000	1200
Sw	7000	1200
Sw	>12000	1200

2.6.3.4 TREE IMPROVEMENT

The projected gain from improved seed for the Dawson Creek TSA is tabulated in Table 2.4.4.

Table 2.4.4 Project gain from improved tree seed, Dawson Creek TSA.

Species & Seed Zone	Elevation (m)	Gain from Improved Seed (%)		
		98-99	99-00	2007-08
Sx PR low	<1200	-	-	23
Sx PG low	<1200	14	15	17
Sx PG high	>1200	17	17	16
Fdi PG all	<1100	19	19	19

2.6.4 TSR 1 MANAGEMENT ASSUMPTIONS

In addition to the inventory, or current state of the forest, assumptions about how it will be managed as essential for determining a silviculture strategy.

2.6.4.1 INVENTORY PROFILE

The inventory profile (species composition) of the timber harvesting land base is expected to change over time. Table 2.4.5 records the trend in species profile resulting from the harvesting schedule of the TSR base case. Mixedwood stands are a component of Table 2-8.

Table 2.4.5 Current inventory profile by volume and area, Dawson Creek TSA 1994.

	Current Species Profile of the THLB	
Species	**Volume%**	**Area%**
B	22	4
P	28	32
S	28	29
At	22	35
Total	**100**	**100**

2.6.4.2 MANAGEMENT ZONES AND FOREST COVER REQUIREMENTS

The TSR management zones and their associated forest cover requirements are listed in Table 2.4.6 and the minimum harvest ages are summarized in Table 2.4.7.

Table 2.4.6 Management zones and forest cover requirements, Dawson Creek TSA 1994

Management Zone		Age 1 (years)	Maximum per cent area younger than Age 1
1	Coniferous leading, general	23	33
2	Coniferous leading, retention VQO	27	6
3	Coniferous leading, partial modification VQO	30	13
4	Coniferous leading, modification VQO	28	24
11	Deciduous leading, general	10	33
12	Deciduous leading, retention VQO	15	8
13	Deciduous leading, partial retention VQO	15	14
14	Deciduous leading, modification VQO	15	29

Table 2.4.7 Minimum harvestable ages by leading species and site class, Dawson Creek TSA 1994

	Site:		
Species	**G**	**M**	**P**
Sb	80	100	150
P	60	70	90
B	70	80	130
At	60	70	80
Ac	70	70	80
Coniferous minor	70	70	70
Pl, height class 2	80	80	80

2.6.4.3 HARVESTING PRACTICES

The 5-year average area harvested is 3 343 ha. This area is a combination of coniferous and deciduous area. 99.9% of the THLB area is managed under even-aged silvicultural systems (clearcutting), generating 99.7% of the TSA volume.

The annual harvested area will increase in the next 20 years and for the foreseeable future for two reasons: 1. a new deciduous licence, amounting to 600 000m^3, has been awarded, and 2. a greater amount of partial cutting (in conifer stands) is expected.

2.6.5 TIMBER SUPPLY DYNAMICS AND THE AAC

The Dawson Creek TSA timber supply analysis (1994) separates the timber supply forecast into coniferous and deciduous components. This section is therefore pesented in two parts:

- Coniferous Timber Supply Dynamics, which deals only with the coniferous harvest forecast and sensitivity analysis;
- Deciduous Timber Supply Dynamics, which deals only with the deciduous harvest forecast and sensitivity analysis.

2.6.5.1 CONIFEROUS TIMBER SUPPLY DYNAMICS

The 1994 TSR, upon which the current AAC determination was based, shows forecasts an even-flow harvest of 972 000 m^3 maintained throughout the entire planning horizon (Figure A1-1). This harvest level is approximately 13% higher than the current AAC. Mature pine stands less than 19.5 metres will contribute 164,000 m^3 per year, or 15% to the total annual harvest from coniferous stands.

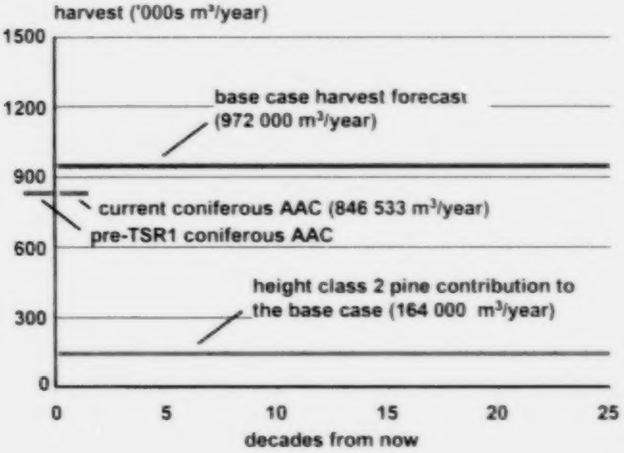

Figure 2.4.2 Coniferous base case harvest forecast, Dawson Creek TSA, 1994.

This even-flow harvest level for coniferous stands can be attributed to a low rate of harvest that is close to the productive capacity of the management unit and the age class structure of the coniferous timber harvesting land base (Figure 2.4.3). Extensive stands of mature timber allow the heavily concentrated younger stands (ages 80 to 110 years) to be preserved until later periods. These younger age classes can mature and be gradually harvested, while the regenerating stands mature. The age class distribution at 150 years (not shown) suggests a "normal" forest.

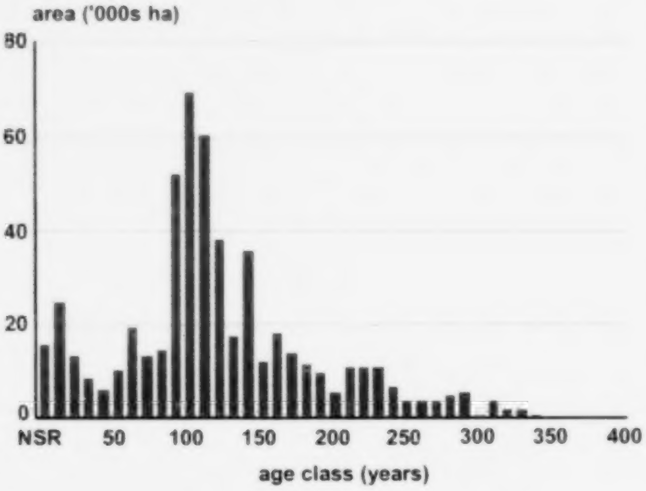

Figure 2.4.3 **Current coniferous age class distribution-timber harvesting land base, Dawson Creek TSA 1994.**

Even-Flow Harvest Level Effects

The even-flow harvest level rations mature merchantable stands until later periods allowing younger stands to reach merchantable ages without a decline in the harvest level. This drawing down of the mature stock is demonstrated in Figure 2.4.4, which forecasts a steady decline in total and harvestable growing stock for the first 100 to 150 years. After this time, both measures of stock increase and reach a steady long-term level.

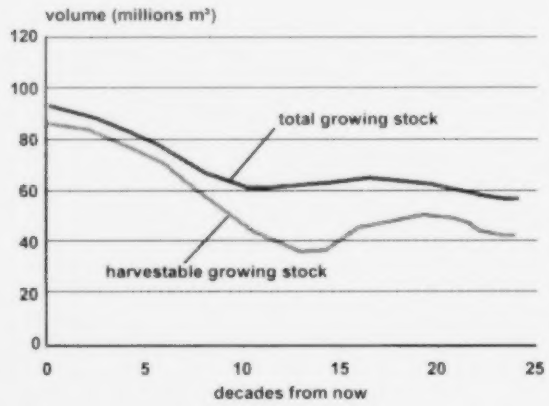

Figure 2.4.4 **Total and harvestable growing stock, coniferous base case, Dawson Creek TSA, 1994**

The average volume per hectare of timber harvested over time (not shown) remains steady until 150 years when there is a decline in the average volume. The average age of harvested stands (Figure 2.4.5) declines quickly over the first 4 decades of the planing period from 280 years to 180 years, and then more slowly to the long-term level of 130 years. This decline can be attributed to older stands ranging in ages 130-340 years being harvested for the first 40 years. Once these stands are harvested, the average age declines as the heavy concentration of younger stands become merchantable.

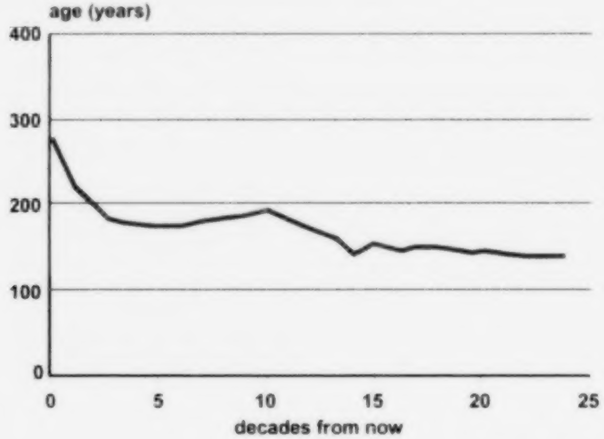

Figure 2.4.5 **Average age of harvested stands over time, coniferous base case, Dawson Creek TSA, 1994**

Robustness of the Base Case Harvest Forecast

Figure 2.4.6 demonstrates the robustness of the base case harvest forecast. The initial harvest level can be increased by 17% above the base case forecast, and reduced gradually over 2 decades (<10% per decade) down to the LTHL. If the initial harvest level is increased by 51%, the reduction to LTHL occurs over 4 decades and a shortfall is forecast to occur at 180-200 years.

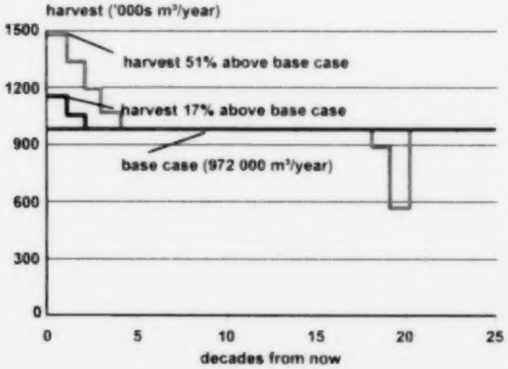

Figure 2.4.6 **Alternative harvest flows using the coniferous base case, Dawson Creek TSA, 1994**

Green-up and Cutblock Adjacency

A 5-year decrease in green-up age results in a small benefit of about 1.5% of the even flow rate across the entire planning horizon. This increase can be attributed to increased harvesting in visually sensitive areas, which were previously set aside until the age when a required height was reached.

In the coniferous base case forecast the forest cover requirement used to model cutblock adjacency is based on the assumption that a maximum of 33% of the area can be less than 3 metres tall at any given time – a 3-pass harvesting system. Increasing the constraint to a 5-pass system does not change the base case forecast. Figure 2.4.7 illustrates the effects of harvesting on a 6-pass system -- modest shortfalls occur periodically across the planning horizon. This result reinforces the earlier observation that the base case harvest forecast is quite robust.

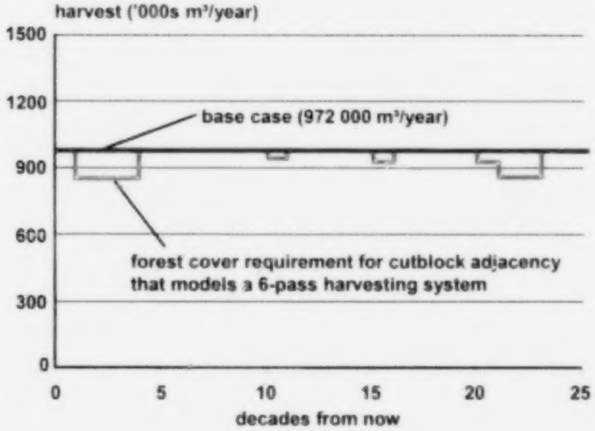

Figure 2.4.7 **Coniferous harvest forecast with a more stringent cutblock adjacency requirement, Dawson Creek TSA, 1994**

Changing Stand Yields

Increasing existing stand yields causes a 16% increase in the initial rate of harvest (Figure 2.4.8). This long-term level is maintained until period 160 when there is a step down to the long term harvest level.

Figure 2.4.8 also shows the implications of increasing and decreasing the regenerated stand volumes by 20%. Note that the effects of changing yields of existing and regenerated timber were determined independently.

Also plotted on Figure 2.4.8 is the transition (estimated) from natural to managed stands. This transition at 180 years marks the end of the mid-term of the timber supply forecast and the beginning of the long term. The short term is arbitrarily defined as the first two decades.

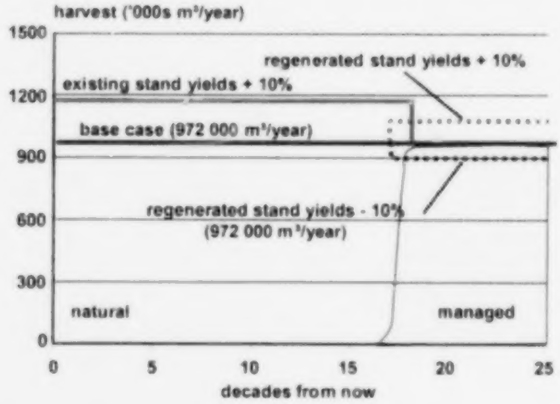

Figure 2.4.8 **Coniferous harvest forecasts with changes in estimated stand yields**

Coniferous Timber supply Dynamics -- Summary

The base case harvest forecast for coniferous stands is even-flow due to two features: the low rate of harvest (pre-TSR and current) that is close to the productive capacity of the management unit, and an age class structure that is heavily weighted to mature timber.

This timber supply forecast is robust with respect to management modelling parameters such as green-up age and adjacency. Increasing existing and regenerated stand yields results in significant increases in timber supply.

2.6.5.2 DECIDUOUS TIMBER SUPPLY DYNAMICS

The 1994 TSR, upon which the current AAC determination was based, shows the deciduous allowable annual cut can be maintained for 10 years without causing a reduction in future harvest levels (Figure 2.4.9). Starting from the current deciduous AAC of 886 500 m³/yr , the harvest declines steeply at 22% each decade until the long term harvest level of 480 000m³/yr is reached in the fourth decade. The LTHL is 46% lower than the current AAC. Cottonwood stands are expected to contribute 92 000 m³ per year, or 11% to the total harvest from deciduous stands over the long term.

Impending Scarcity of Harvestable Timber

Figure 2.4.10 overlays total and harvestable growing stock on the projected harvest for the base case forecast, showing how the timing of the depletion of the growing stock coincides with the reduction in harvest level or falldown. The harvestable growing stock is at its minimum level in decade 7, indicating a scarcity of timber in decades 6-8.

Figure 2.4.11 displays the deciduous age class distribution of the timber harvesting land base currently, in 50 and in 100 years. Much of the area in the current age class distribution is between 70 and 120 years old, with little timber in the younger age classes. An important management consideration in this TSA is the increased risk of decay in aspen and cottonwood older than 120 years, suggesting that a high rate of harvest might be desirable in the first few decades. Another important factor affecting the choice of short-term harvest level in the base case forecast is the need to ration the stock of existing mature timber until enough regenerating stands reach minimum harvestable age to support the long-term harvest level.

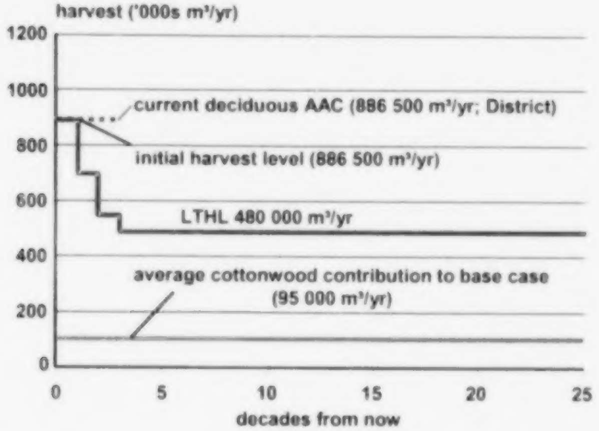

Figure 2.4.9 Deciduous base case harvest forecast, Dawson Creek TSA

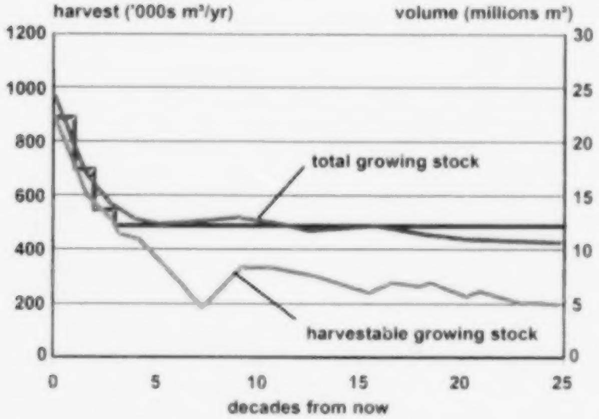

Figure 2.4.10 Deciduous base case harvest forecast and growing stock inventory, Dawson Creek TSA

Rationing Existing Mature Timber

The rate at which the stock of existing mature timber can be depleted depends partly on the rate at which existing immature and regenerated timber becomes large enough to harvest. Since there is a shortage of young stands in the existing forest, the harvest level must be reduced rapidly after the first decade to conserve existing mature timber for harvesting in later decades. The LTHL of 480 000 m³/yr is reached in decade 4.

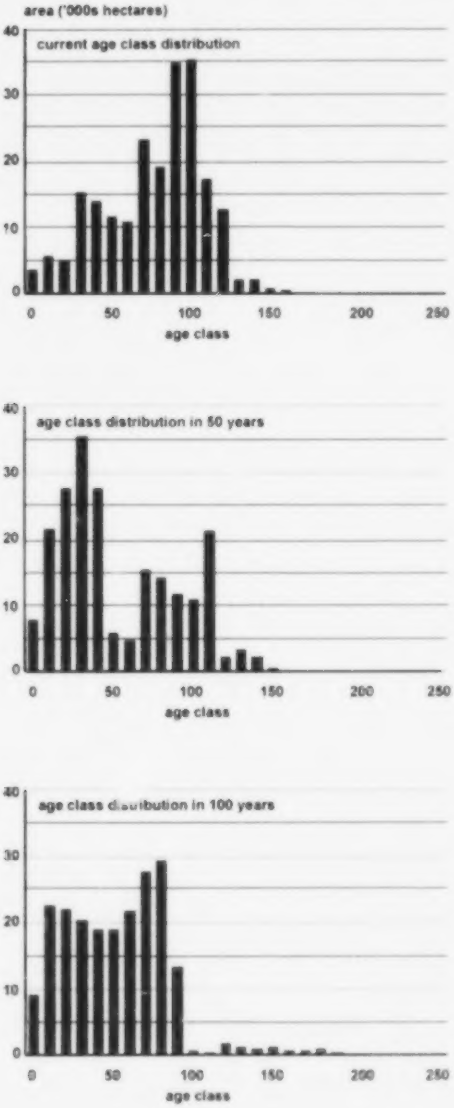

Figure 2.4.11. **Stand age class distribution over time, deciduous base case Dawson Creek TSA**

Figure 2.4.12 shows alternative forecasts for comparison with the base case. If the initial harvest level is set at 985 000 m^3/yr, the LTHL must be reduced to below that of the base case. In other words, the rate of harvest must be constrained to ensure that the inventory is not drawn down too quickly. It is this mechanism shaping timber supply – constraints on the rate of change of the harvest level – that provides a means of capturing silvicultural benefits in the short term. Note that the efficacy of this effect is determined by the shape of the timber supply forecast and hence is specific to a management unit.

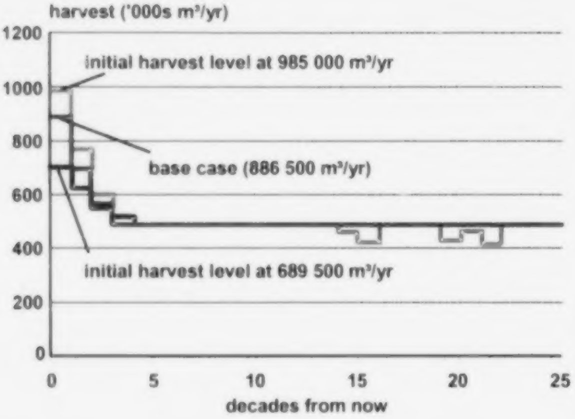

Figure 2.4.12. **Alternative harvest flows using the deciduous base case, Dawson Creek TSA Addendum, 1996**

Minimum Harvest Ages

Minimum harvest ages were set by District staff based on the age at which the average annual volume growth of a stand is within 5% of its maximum or "culmination" age. Minimum harvestable ages might be reduced further through silviculture, and Figure 2.4.13 illustrates how much and when timber supply might be affected by doing so.

In the short term, reducing minimum harvest ages results in a significant increase in timber supply. Reducing minimum harvestable ages makes young and regenerating stands available for harvest sooner, and increases the amount of timber that is currently above the minimum harvestable age. The combination of volume available from both the young and older age classes increases the harvest level.

Increasing the minimum harvestable age has no short-term effect, and a small long-term effect on harvest levels because the minimum harvestable ages are just slightly less than the culmination ages. Since the majority of stands have reached culmination increasing the minimum harvestable age has no effect on the harvest level. If there were no surplus of mature stands, increasing the minimum harvestable age would mean regenerating stands could not be harvested as early in the planning horizon, therefore harvest levels would have to decrease as mature stands are depleted.

Green-up

As illustrated in Figure 2.4.14, a 5-year decrease in green-up results in benefits across the entire planning horizon. The even-flow rate of harvest can be increased to approximately 4% above the base case. Again this increase can be attributed to increased harvesting in visually sensitive areas. Increasing the green-up ages means that harvestable area is constrained until certain height requirements are met.

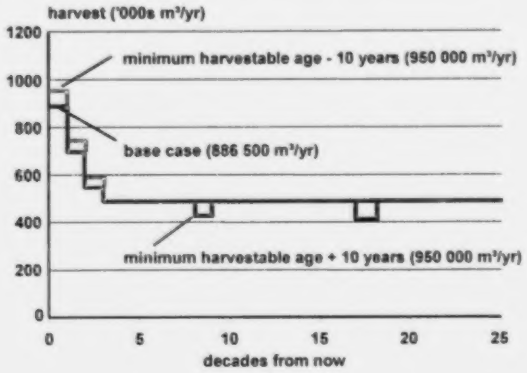

Figure 2.4.13 **Deciduous harvest forecast with minimum harvestable ages +/- 10 years**

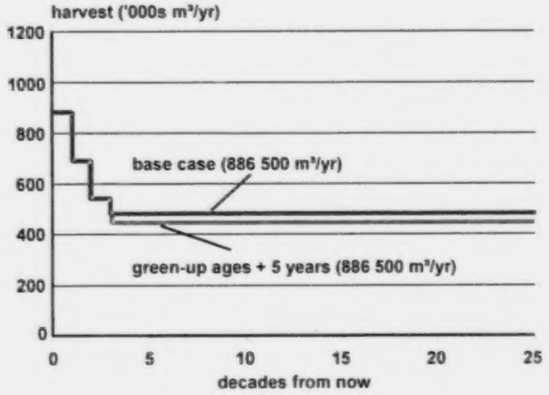

Figure 2.4.14 **Deciduous harvest forecast with green-up periods + 5 years, Dawson Creek TSA Addendum, 1996**

Increasing Stand Yields

Increasing stand yields has a significant effect on the short and long harvest levels (Figure 2.4.15). Since there is a majority of stands over the minimum harvestable age, increasing yield estimates will mean that increased volume will be obtained from these stands. As the older stand are used up, there will be a decline in the harvest, as seen with the base case, but the harvest level will be greater than the base case because regenerating stands will have greater volumes contributing the harvest level.

Decreasing the stand yields causes a drastic decline in the harvest level. This can be attributed to the fact that the potential volume from the mature stands is lessened due to the decreased yield estimates. As these mature stands are harvested there is a steady decline in the harvest level. Once the regenerating stands reach minimum harvestable age the long term harvest level is reached, but is below the base case because of decreased yield estimates.

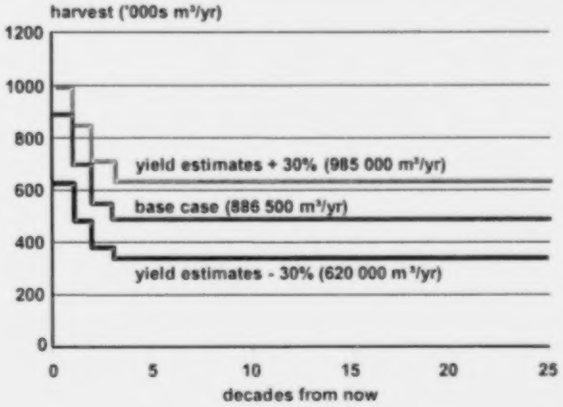

Figure 2.4.15 Deciduous harvest forecast with adjusted yield estimates

Increasing the Timber Harvesting Land Base

Various silvicultural activities can be interpreted as bringing land into the timber harvesting land base and so the TSR sensitivity analyses of the effect of increasing the timber harvesting land base (Figure 2.4.16) will provide information on the magnitude and timing of the benefits. Increasing the timber harvesting land base increases timber supply across the whole planning horizon.

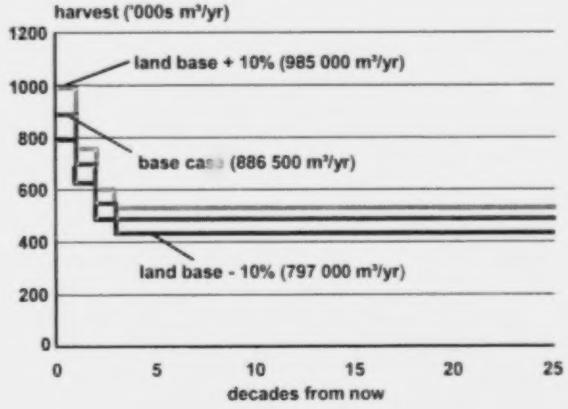

Figure 2.4.16 Changes to the timber harvesting land base

Deciduous Timber supply Dynamics -- Summary

The supply of deciduous timber in the Dawson Creek TSA is shaped by the interaction of the productivity of the unit, the current rate of harvest, and administrative constraints on harvest flow. Specifically, the age class structure of the TSA is characterized by a physical shortage of younger stands approaching minimum harvesting age and the current and scheduled rates of harvest substantially exceed the growth rate and the long term harvest level. This physical shortage of supply is brought forward to decades 2 and 3 by the constraints on the rate of change of the harvest level, which ration the remaining mature timber to sustain the harvest through the periods of scarcity.

2.6.6 KEY ISSUES AND POTENTIAL SILVICULTURAL STRATEGIES

This section identifies the key Sustainable Harvest issues facing the TSA, as well as potential silvicultural strategies considered suitable to address them. Of those resource supply issues described in Section 2.4.6, four were considered key by management unit stakeholders:

- Uncertainty about critical inventory and growth and yield information
- Productivity losses associated with backlog sites in the timber harvesting landbase
- Potential deciduous timber supply falldown in the short, medium and longterm
- Uncertainty of security of coniferous timber supply

Potential silvicultural strategies are those silvicultural interventions having potential to either maintain or increase future timber supply at the TSA level. Strategies considered feasible and desireable by Dawson Creek stakeholders are listed in Table 2.4.8. The forest level impacts of each stategy and tactic are estimated in Table 2.4.9. This set of strategies must be considered provisional at this time; they must be analysed and evaluated in further forest estate modelling. Local technical expertise, current policies and present uncertainties surrounding some of the following strategies are reflected in the SH investment recommendations.

Table 2.4.8 Potential silvicultural strategies and tactics in the Dawson Creek TSA.

Key Issues	Silvicultural Strategies	Silvicultural Tactics	Target Stands	Rank
Uncertainty in critical issues	**1-1** Improve Knowledge (SI estimates on backlog)	add growth intercept to FG surveys of treated backlog	Backlog NSR	1
		add growth intercept to FG surveys (re FG)	Backlog NSR (in BWBS)	1
	1.2 Improve Knowledge (Deciduous Stocking)	expand survey to include deciduous—update ledger	Regenerated stands	1
	1-3 Improve Knowledge (Monitoring for vegetation management)	install NIVMA plots		1
Loss of Productivity on Backlog Sites	**2-1** Maintain Timber Harvesting Land Base (Retire all NSR)	survey to determine opportunities	NSR backlog	1
		conifer treatment regimes		1
		deciduous treatment regimes		1
		mixedwood treatment regimes		1
	2-2 Maintain Timber Harvesting Land Base (Convert NCbr to THLB	Cut and pile mound, plant, herbicide, survey, fill-plant	NC Br	3
	2-3 Maintain Timber Harvesting Land Base (Convert NCbr to grazing land)	survey and grazing plan	NC Br	2
		MSP and seeding		3
Decline in Deciduous Harves	**3-1** Increase Yields (Protect regenerating aspen stands from grazing)	grazing plan to move cattle out of susceptible young stands	BWBS – all stands	2
		implement grazing plan	BWBS – all stands	3
Security of Conifer Harvest	**4-1** Improve Operability (Reach FG earlier)	survey (pre-early FG)	Shelterwood Stands in ESSF	3
	4-2 Maintain Productivity of Timber Harvesting Land Base (Mitigate impact of calamagrostis)	develop methodology for assessing risk pre-harvest	BWBS – all stands	1

Table 2.4.9 Recommended silvicultural strategies for the Dawson Creek TSA.

Key Issues	Objectives	Silvicultural Strategies	Silvicultural Tactics	Target Stands	Opportunity Area (ha)	—Timber Supply Effects —				Habitat Effects	Jobs Days/ ha	Cost $/ha¹	Rank
						Short	Mid	Long	Qual				
Uncertainty - critical SH issues	Reduce uncertainty in critical SH management issues	**1-1** Improve Knowledge-Productivity potential (	add growth intercept (to reforested backlog FG surveys)	backlog NSR	2500	0	+/-	+/-	?	0		10 to 30	1
			add growth intercept to FG surveys (re FG)	backlog NSR (in BWBS)	2500	0	+/-	+/-	?	0		10 to 30	1
		1-2 Improve Knowledge Deciduous stocking	expand surveys (to include deciduous to conifer stocking assessement pdate ledger)	regenerated stands	2500	0	+/-	+/-	0	0		2	1
		1-3 Improve Knowledge-Response Monitoring	install NIVMA plots		6 - 8 plots/yr	0	+	+	0	+/-		1100/plot	1
Productivity losses- backlog	Maintain historical production levels	**2-1** Maintain THLB- Retire all NSR	survey to determine opportunities	NSR backlog	2500/yr	0	+/-	+/-	0	0		40	1
			conifer treatment regime		800/yr	0	+/-	+/-	0	0		1800	1
			deciduous treatment regime		800/yr	0	+/-	+/-	0	0		0	1
			mixedwood treatment regime		900/yr	0	+/-	+/-	0	0		2600	1
		2-2 Maintain THLB- Convert NCbr to THLB	cut and pile	NC Br	500/yr		+	+		0		350	3
			mound		500/yr		+	+		0		550	3
			plant		500/yr		+	+		0		1000	3
			herbicide		500/yr		+	+		0		450	3
			survey		500/yr		+	+		0		80	3
			fill-plant		500/yr		+	+		0		500	3
	shift grazing to non-productive land	**2-3** Maintain THLB (Convert NCbr to grazing land)	survey and grazing plan	NC Br	500/yr		+	+		-		25	2
			MSP and seeding		100/yr		+	+		-		500	3
Deciduous Supply Falldown	improve yields of regenerating aspen	**3-1** Improve Yields (Aspen Stand protection)	grazing plan (to move cattle out of susceptible young stands)	BWBS	1000/yr		+	+				25	2
			implement plan		1000/yr		+	+				50	3
Security of coniferous supply	improve operability of regenerating stands	**4-1** Improve Operability (earlier FG)	survey (pre-early FG)	shelterwood stands in	500/yr	+/-	+/-	+/-				50	3

	ensure prompt and complete restocking after harvest	**4-2** Improve Yields (mitigate impact of calamagrostis)	develop methodology for assessing risk pre-harvest	ESSF BWBS	1500/yr	0	0	0		0		10	1

2.6.6.1 ISSUE 1: UNCERTAINTY ABOUT CRITICAL INVENTORY AND GROWTH AND YIELD INFORMATION

Strategy 1.1: Improve Estimates of Site Productivity Potential of Disturbed Stands

TACTIC 1 IMPROVE SITE INDEX ESTIMATES FOR NON-FREE GROWING BACKLOG STANDS

Target Stands:

Backlog stands that are not FG. Survey 2500 ha/yr using the growth intercept method to obtain more accurate SI information. This updated information would be used to update productivity potential of analysis units for future timber supply reviews.

TACTIC 2 IMPROVE SITE INDEX ESTIMATES FOR FREE-GROWING, CURRENT STANDS IN THE BWBS BEC ZONE

Target Stands:

Current, free growing stands in BWBS BEC zone. Survey 2500 ha/yr using the growth intercept method to obtain more accurate SI information. This updated information would be used to update productivity potential of analysis units for future timber supply reviews.

Expected Forest Level Benefits:

The strategic aim of both tactics is to increase confidence of site productivity potential estimates by obtaining more accurate Site Index (SI) information on backlog and current stands. If site index values are underestimated in the TSA, improved information would allow for additional volume harvest in the mid and long term.

Strategy 1.2: Improve Estimates of Site Productivity Potential of Disturbed Stands

TACTIC 1 ADD DECIDUOUS SPECIES TO CONIFEROUS STOCKING ASSESSMENTS

Target Stands:

Recently regenerated areas throughout the TSA.

Expected Forest Level Benefit:

The strategic aim of this tactic is to utilize deciduous stocking where it exists, rather than invest effort to convert it to conifer stocking. This change in current practice requires that stocking surveys be modified to recognize deciduous species. The current management approach is to split the land base into separate components supporting coniferous and deciduous AAC's. This complicates decision-making since shifting hectares after harvest from one component to the other (e.g., coniferous to deciduous) would change the land base size, and therefore would affect future AACs.

The LRMP recommends maintaining the areas of deciduous and coniferous species at or near their present levels. Where stocking has changed from one to the other, it was suggested that some form of land base accounting (e.g., a ledger system) should be used. The recommendation was for equal areas presently deciduous to be changed to conifer where suited, e.g., a nurse tree shelterwood where the aspen is removed leaving a stocked spruce stand. This is a large issue that goes beyond maintaining deciduous vs. conifer stocking. It encompasses mixedwood management and the numerous pathways that it provides. Prior to implementing this approach, consultation with those responsible for mixedwood management policy is required.

It should be noted that currently where there is insufficient coniferous stocking in backlog NSR areas (from harvesting or fire disturbance origin) deciduous stocking of acceptable species and quality is recorded and retained. These areas are then managed for deciduous species, and should be added to the deciduous land base.

Strategy 1.3: Improve Knowledge of Silvicultural Responses

TACTiC 1 – MONITOR OPERATIONAL VEGETATION MANAGEMENT TREATMENTS (INSTALL NIVMA PLOTS

Target Stands:

All pre-free growing stands in the TSA.

Expected Forest Level Benefits:

In TSR1 the Chief Forester indicated that vegetation management issues could ultimately affect the mid-and long-term coniferous timber supply. Installation of NIVMA plots (6 – 8 plots per year) will track success of various operational treatment regimes, aiding in future yield projections and timber supply determinations.

2.6.6.2 ISSUE 2: PRODUCTIVITY LOSSES ASSOCIATED WITH BACKLOG SITES IN THE TIMBER HARVESTING LANDBASE

Strategy 2.1: Maintain or increase the timber harvesting land base

TACTIC 1 - RETIRE NSR

Target Stands:

All pre-'87 NSR and SR impeded backlog stands in the TSA.

Expected Forest Level Benefits:

A two-phased approach was suggested for retiring NSR. The first step is to survey to determine NSR status and treatment opportunities. Past practices, which were oriented to maintaining the coniferous land base, used conifer-dominated stocking standards. With recent harvesting of deciduous species there has been pressure to maintain the deciduous land bases and a re-examination of stocking standards. There is a need for improvement in the mixedwood stocking standards to allow for varying combinations of species given that many backlog areas have regenerated to mixtures of coniferous and deciduous species.

Draft mixed-wood stocking standards are available and may suffice for the time being. Recommendations for treatment options should be made for blocks not meeting the minimum stocking. The stands to be assessed are from the NSR backlog. A total of about 2500 ha per year has been suggested for assessment.

The second step is to implement regimes to address deficiencies in coniferous stocking. Conifer regime options include brushing existing stems, site prep, fill planting and additional brushing. An estimated 800 ha per year may be treatable. Deciduous regime– if deemed stocked with deciduous accept as is and record in a ledger accordingly. An estimated 800 ha per year may be treatable. Mixed-wood regime options include brushing existing stems, site prep, fill planting and additional brushing. An estimated 900 ha per year may be treatable. TSR1 assumes all of this land to be restocked to conifers. Some form of ledger is needed to account for deciduous-leading blocks.

TACTIC 2 – CONVERSION OF NON-PRODUCTIVE STANDS

and

TACTIC 3 – CONVERSION OF NON-PRODUCTIVE STANDS TO GRAZIING

Target Stands:

Non-productive categories of NSR backlog in the TSA, and NC Br in BWBS that can be converted to grazing land

Expected Forest Level Benefits:

The THLB may be increased by afforesting areas of NC Br. Target areas of NC Br that have been roaded since FRDA-funded conversions in the late 1980's. A rigorous treatment regime is required to successfully convert NCBR to make it operable. A regime of six treatments was defined, including: cut and pile, mound, plant, brush with herbicide, survey, and fill-plant. An estimated 500 ha per year may be treatable.

Depending upon the site productivity this strategy could increase the mid- and short-term harvest levels incrementally, possibly offsetting reductions from sub-optimal stocking elsewhere.

To reduce grazing pressure on newly restocked aspen cutblocks, the intent is to convert suitably located NC BR areas to grazing land. The first step is to determine the opportunities and feasibility for this to occur (with 500 ha to be assessed in the fist year). Once areas have been identified and surveyed, site preparation and seeding would follow (with 100 ha estimated for the first year).

2.6.6.3 ISSUE: PREDICTED DECIDUOUS TIMBER SUPPLY FALLDOWN

Stategy 3.1: Improve Yields of Existing and Regenerating Stands

TACTIC 1 – PROTECT REGENERATING YOUNG ASPEN STANDS FROM GRAZING

Target Stands:

recently harvested aspen cutblocks in the BWBS BEC zone.

Expected Forest Level Benefits:

The first activity needed to protect regenerating aspen stands from grazing is to create a grazing plan that enables successful establishment of deciduous harvest blocks (1000 ha might be appropriate in year one). The intent is to allow aspen stands to become fully stocked so as to provide medium-and long-term fibre. The grazing plan may require fencing or other forms of cattle management to limit access to recently harvested aspen cutblocks.

2.6.6.4 ISSUE 4: SECURITY OF CONIFEROUS TIMBER SUPPLY

Strategy 4.1: Improve Yields of Existing and Regenerating Stands

Two related sub-issues concern coniferous timber supply. Achieving full yield production is problematic where a balsam understory remains after harvesting the spruce overstorey in shelterwood systems in the ESSF BEC zone. The second sub-issue concerns the impact of vegetation competition of *Calamagrostis canadensis* on regenerating conifers.

TACTIC 1 - ASSURE ACHIEVEMENT OF FREE-GROWING STATUS

Target Stands:

Residual balsam remaining after removal of spruce overstorey in ESSF shelterwood harvests.

Expected Forest Level Benefits:

In blocks where spruce has been harvested leaving a balsam understory, the performance of the residual balsam is uncertain. To provide greater certainty for future predictions some form of analysis is required to provide better estimates of future growth and yield in these types. Discussion with the Regional Research Section should occur prior to any further work on this subject. Experience at the Aleza Lake Research facility and other partial-cutting initiatives and literature may help define the problem and provide guidance.

TACTIC 2 - MITIGATE IMPACT OF CALAMAGROSTIS CANADENSIS

Target Stands:

All harvested areas in BWBS BEC zone

Expected Forest Level Benefits:

Calamagrostis canadensis can significantly reduce stocking and growth potential in regenerating harvested blocks. To ensure adequate basic reforestation is accomplished promptly, a procedure to help rate blocks for their potential for grassing-in is needed. It was estimated that field-testing could occur on 1500 ha per year. The Regional Research Section should be contacted to determine what if any tools are presently available for grass prediction, and what treatment options have been used successfully.

2.6.6.5 RECOMMENDED KNOWLEDGE STRATEGIES

There are many related TSA silvicultural issues not directly addressable via silvicultural practices. Many of these require investigation and further study. Table 2.2.10 identifies, and ranks the importance of 9 Sustainable Harvest knowledge gap issues.

Table 2. Issues require further investigation

Knowledge Gap Issues	Rank
Developing silviculture systems for mixedwood stand types.	1
Developing appropriate strategies to resolve conflicts between uses of coniferous and deciduous timber.	2
Explore concept of ledger to track the balance of the coniferous and deciduous land bases.	3
Reach agreement on mixedwood stocking standards.	4
Forest cover re-inventory (VRI and other inventories).	5
Develop aspen planting stock, identify superior aspen clones.	6
Develop methodology for pre-harvest assessment of risk of problems with *Calamagrostis*. The Regional Research Section should be contacted to determine what if any tools are presently available for grass (*C. canadensis*) prediction, and what treatment options have been used successfully.	7
* Improve estimates of OAF 1 and OAF 2 in regenerating stands.	8
* Improve methods for projecting growth and yield of deciduous species, (e.g., through development of MGM), particularly mortality functions in pure, deciduous leading, and mixed stands.	9

2.6.7 MANAGEMENT UNIT SUSTAINABLE HARVEST PLAN – 2002-2007

2.6.7.1 ENHANCED FORESTRY PROGRAM

Dawson Creek Forest District

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Stand Tending	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	0	0	0	0	0.00	0	
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	0	0	0	0	0	0.00	0	
Other	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Planning and prescriptions							0	
Total dollars							0	

Forest Health Enhancement

	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	Unit Cost ($/ha)	Funding ($)	Priority
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Other treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Habitat Supply and Biodiversity Enhancement

	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	Unit Cost ($/ha)	Funding ($)	Priority
Riparian treatments	0	0	0	0	0	0.00	0	
Non-riparian treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Domestic Range

	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	Unit Cost ($/ha)	Funding ($)	Priority
Treatments	0	0	0	0	0	0.00	0	

Enhanced Forestry Activities - Management Unit Total

	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	0	0	0	0	0.00	0	
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	0	0	0	0	0	0.00	0	
Other stand tending activities	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Planning and prescriptions							0	
Studies funding							0	
Total dollars							0	

Dawson Creek TSA, TFL 48[8]

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	0	0	0	0	0.00	0	
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	0	0	0	0	0	0.00	0	
Other	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Planning and prescriptions							0	
Total dollars							0	

Forest Health Enhancement

Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Other treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Habitat Supply and Biodiversity Enhancement

Riparian treatments	0	0	0	0	0	0.00	0	
Non-riparian treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Domestic Range

Treatments	0	0	0	0	0	0.00	0	

Enhanced Forestry Activities - Management Unit Total

Surveys	0	0	0	0	0	0.00	0	
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	0	0	0	0	0	0.00	0	
Other stand tending activities	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Planning and prescriptions							0	
Studies funding							0	
Total dollars							0	

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[8] Note! TFL data have been incorporated into the Forest District plans; they are presented here for information purposes only, and are not cumulative to the TSA Enhanced Forestry Program.

2.6.7.2 BACKLOG FORESTRY PROGRAM

Dawson Creek Forest District

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Legal Obligations	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	1100	1100	1100	1100	1100	40.00	44000	
Site preparation	300	300	300	300	300	750.00	225000	
Planting	395	395	395	395	395	540.00	213300	
Brushing	1666	1666	1666	1666	1666	550.00	916300	
Max. density spacing	260	260	260	260	260	1000.00	260000	
Totals hectares	3721	3721	3721	3721	3721	445.74	1,658,600	
Seed purchase	395	395	395	395	395	250.00	98750	
Total legal obligations							1,757,350	
Backlog Reforestation								
Surveys	200	200	200	200	200	25.00	5000	
Site preparation	125	125	125	125	125	750.00	93,750	
Planting	405	405	405	405	405	540.00	218,700	
Brushing	0	0	0	0	0	0.00	0	
Totals hectares	730	730	730	730	730	434.86	317,450	
Seed purchase	405	405	405	405	405	523.00	212,000	
Prescriptions and planning dollars							3,000	
Total backlog reforestation							532,450	
Impeded areas								
Surveys	14700	14700	14700	14700	14700	25.00	$367,500	
Brushing	2334	2334	2334	2334	2334	560.00	1,283,700	
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	17034	17034	17034	17034	17034	96.94	1,651,200	
Prescriptions and planning dollars							220,500	
Total impeded areas							1,871,700	
Site Restoration								
Fill planting	0	0	0	0	0	0.00	0	
Rehabilitation	0	0	0	0	0	0.00	0	
Reforestation	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Seed purchase	0	0	0	0	0	0.00	0	
Prescriptions and planning dollars							0	
Total site restoration							0	
Backlog Program Activities - Management Unit Total								
Surveys	16000	16000	16000	16000	16000	26.03	416500	
Site preparation	425	425	425	425	425	750.00	318750	
Planting	800	800	800	800	800	540.00	432000	
Brushing	4000	4000	4000	4000	4000	550.00	2200000	
Density spacing	260	260	260	260	260	1,000.00	260000	
Totals hectares	21485	21485	21485	21485	21485	168.83	3627250	
Seed purchase	800	800	800	800	800	388.44	310750	
Prescriptions and planning							223,500	
Recommended studies							50,000	
Total backlog program							4,211,500	

Dawson Creek TSA, TFL 48[9]

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Legal Obligations	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	3000	2000	1000	0	0	40.00	120000	
Site preparation	500	500	0	0	0	650.00	325000	
Planting	1500	600	500	0	0	400.00	600000	
Brushing	1000	0	0	0	0	450.00	450000	
Max. density spacing	0	0	0	0	0	0.00	0	
Totals hectares	6000	3100	1500	0	0	249.17	1,495,000	
Seed purchase	1500	600	500	0	0	500.00	750000	
Total legal obligations							2,245,000	
Backlog Reforestation								
Surveys	0	0	0	0	0	0.00	0	
Site preparation	0	0	0	0	0	0.00	0	
Planting	0	0	0	0	0	0.00	0	
Brushing	0	0	0	0	0	0.00	0	
Total backlog reforestation							0	
Impeded areas								
Surveys	0	0	0	0	0	0.00	0	
Brushing	1000	500	200	0	0	450.00	450000	
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	1000	500	200	0	0	450.00	450,000	
Prescriptions and planning dollars							40,000	
Total impeded areas							490,000	
Site Restoration								
Fill planting	0	0	0	0	0	0.00	0	
Rehabilitation	0	0	0	0	0	0.00	0	
Reforestation	0	0	0	0	0	0.00	0	
Total site restoration							0	
Backlog Program Activities – Man. Unit Total								
Surveys	3000	2000	1000	0	0	40.00	120000	
Site preparation	500	500	0	0	0	650.00	325000	
Planting	1500	600	500	0	0	400.00	600000	
Brushing	2000	500	200	0	0	450.00	900000	
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	7000	3600	1700	0	0	277.86	1945000	
Seed purchase	1500	600	500	0	0	500.00	750000	
Prescriptions and planning							40,000	
Total backlog program							2,735,000	

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[9] Note! TFL data have been incorporated into the Forest District plans; they are presented here for information purposes only, and are not cumulative to the TSA Backlog Forestry Program.

2.6.7.3 MANAGEMENT UNIT FRBC PERFORMANCE

Dawson Creek Forest District

	Performance Measure	Tree Improvement	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
	Inputs											
A	**Planned treatment area (ha) in 2002/2003**	800	0	8,000	425	800	4,000	260	0	0	14,285	
1.0	**Timber Supply**											
1.1	Potential volume/ha gain (m3/ha/yr)	0.41	0	0	0	2.9	0.41	0.25	0	0.40		
1.2	Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3	Pot. total merch. volume increment in 65 years (m3)	21,320	0	0	0	152,880	106,600	4,225	0	0		**285,025**
1.4	Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4	Est. area that will be reclassified as stocked (ha)			2,000								**2,000**
1.5	Est. area that will be declared as free growing (ha)			1,600								**1,600**
2.0	**Wood Value**											
2.1	Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0	**Employment**											
3.1	Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	2	2.61	3.96	4.54	0.18	0.1	
3.2	Estimated total employment (person days/year)	80	0	800	404	1,600	10,440	1,030	0	0	1,429	
3.3	Estimated total full time equivalent positions (FTE)	0	0	4	2	9	58	6	0	0	8	**88**
4.1	**Forest Health Enhancement (ha)**											**0**
5.1	**Habitat Supply**											
5.2	Planned area for specific wildlife forage or habitat maintenance in 2002/2003 (ha)											**0**
5.3	Est. area with secondary value provided to biodiversity (ha)											**4,000**

Dawson Creek TSA, TFL 48[10]

	Performance Measure	Tree Improve-ment	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
	Inputs											
A	**Planned treatment area (ha) in 2002/2003**	1,500	0	1,500	500	1,500	2,000	0	0	0	7,000	
1.0	**Timber Supply**											
1.1	Potential volume/ha gain (m3/ha/yr)	0.41	0	0	0	2.9	0.41	0.25	0	0.40		
1.2	Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3	Pot. total merch. volume increment in 65 years (m3)	39,975	0	0	0	286,651	53,300	0	0	0		379,926
1.4	Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4	Est. area that will be reclassified as stocked (ha)			375								375
1.5	Est. area that will be declared as free growing (ha)			300								300
2.0	**Wood Value**											
2.1	Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0	**Employment**											
3.1	Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	2	2.61	3.96	4.54	0.18	0.1	
3.2	Estimated total employment (person days/year)	150	0	150	475	3,000	5,220	0	0	0	700	
3.3	Estimated total full time equivalent positions (FTE)	1	0	1	3	17	29	0	0	0	4	54
4.1	**Forest Health Enhancement (ha)**											0
5.1	**Habitat Supply**											
5.2	Planned area for specific wildlife forage or habitat maintenance in 2002/2003 (ha)											0
5.3	Est. area with secondary value provided to biodiversity (ha)											0

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[10] Note! TFL data have been incorporated into the Forest District plans; they are presented here for information purposes only, and are not cumulative to the TSA Sustainable Harvest Plan.

2.6.7.4 MANAGEMENT UNIT COMPONENT SUMMARY TABLES

Dawson Creek Forest District

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	0	0	0	0	0	0	0
Planning, prescriptions and seedlings							0
Backlog Program Field Activities	7,000	0	0	0	0	278	1,945,000
Planning, prescriptions and seedlings							790,000
Totals	7,000	0	0	0	0		2,735,000

Performance Measures

Potential total merchentable volume increment in 65 years	379,926 m^3
Estimated ha that will be reclassified as stocked	375 ha
Estimated ha that will be declared as free growing	300 ha
Estimated total full time equivalent positions generated	54 FTEs
Forest health enhancement area	0 ha
Planned area for specific wildlife forage or habitat maintenance	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

Dawson Creek TSA, TFL 48[11]

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	0	0	0	0	0	0	0
Planning, prescriptions and seedlings							0
Backlog Program Field Activities	7,000	0	0	0	0	278	1,945,000
Planning, prescriptions and seedlings							790,000
Totals	7,000	0	0	0	0		2,735,000

Performance Measures	
Potential total merchentable volume increment in 65 years	379,926 m^3
Estimated ha that will be reclassified as stocked	375 ha
Estimated ha that will be declared as free growing	300 ha
Estimated total full time equivalent positions generated	54 FTEs
Forest health enhancement area	0 ha
Planned area for specific wildlife forage or habitat maintenance	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

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[11] Note! TFL data have been incorporated into the Forest District plans; they are presented here for information purposes only, and are not cumulative to the TSA Sustainable Harvest Plan.

2.7 FORT ST. JOHN TSA SUSTAINABLE HARVEST ISSUES AND SILVICULTURAL STRATEGY

This section describes the key sustainable harvest issues in the Fort St. John TSA, and defines a provisional silvicultural strategy to address them. The following strategic analysis is based on a recently completed Type I Silvicultural Analysis, but requires further, detailed forest analysis and modelling to validate and refine underlying assumptions. In the meantime, this strategy is reflected in the proposed, 5 year Sustainable Harvest Plans for the Fort St. John Forest District (Section 2.8).

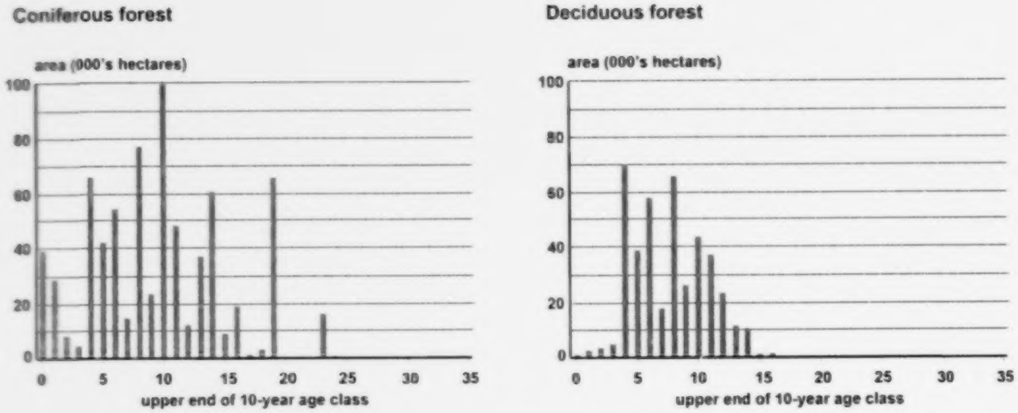
2.7.1 THE RESOURCE LAND BASE

The Fort St. John TSA covers 4 673 049 ha, of which 1 194 000 (25.6%) is considered to be in the timber harvesting land base (THLB).

The site class profile of the THLB is: 20% poor, 65% medium and 15% good site.

The current age class profile of the THLB is skewed toward older age classes, particularly in the coniferous component (Figure 2.5.1).

Figure 2.5.1 **Current age class distribution of the timber harvesting land base, Fort St. John TSA 1995**



Coniferous forest

Deciduous forest

The tree species profile on the THLB is approximately 34% lodgepole pine, 27% spruce, 37% aspen, 1% cottonwood and less than 1% balsam (Figure 2.5.2). Lodgepole pine is the dominant coniferous species. Almost 39% of stands in the THLB are at or above the minimum harvestable age. This mature portion varies by leading species and consists of 41% lodgepole pine, 37% spruce and 38% aspen stands.

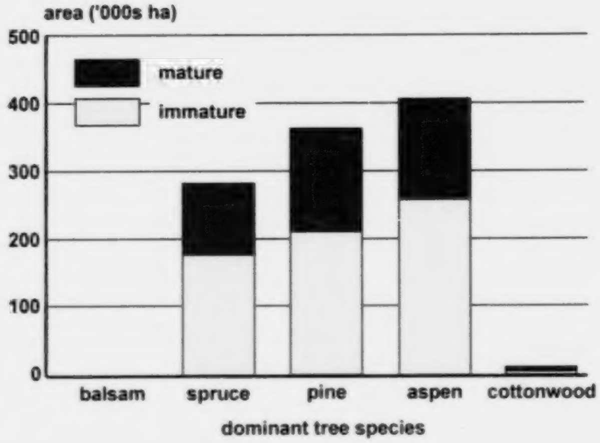


Figure 2.5.2. **Current species composition – timber harvesting land base, Fort St. John TSA 1995**

2.7.2 RESOURCE SUPPLY ISSUES

2.7.2.1 TIMBER SUPPLY – VOLUME

The timber supply analysis for Fort St. John TSA (1995) separated the timber supply forecast into coniferous and deciduous components, and so this section presents timber supply issues for each component separately. Upgrade forest inventories

Coniferous Land Base Issues

Marginal Lodgepole Pine Stands - The base case harvest forecast for the coniferous land base does not decline because the current AAC at the time of the analysis was well below the short-term harvest level. There is substantial timber supply to support the AAC. However there is considerable uncertainty about marginal pine types. Large areas of marginal pine types were included in the timber harvesting land base (THLB) for the timber supply analysis, but it is not clear how much of these stands are actually merchantable. While the area in question affects timber supply, there isn't much that can be done silviculturally to affect it.

Managed Backlog Stands - Of almost 95 000 ha classified as NSR in TSR1, about 52 000 ha (mostly in the coniferous land base) was considered operable and restocked over the first four decades. There is now some uncertainty about how much of this area is actually NSR, how much of it can be rehabilitated, and when.

Curtailment of Herbicide Use - If herbicide use is curtailed in the TSA it is likely that productive sites (comprising about 15% of the THLB) would regenerate to mixed rather than pure coniferous stands. This would reduce the mid- and long-term coniferous harvest levels. Dealing with heavy grass competition and aspen suckering, which are serious regeneration problems in some parts of the TSA, would be more difficult.

Resource Inventory Status - The status of the TSA forest inventory is a major issue facing all stakeholders. The inventory has not been updated for decades, and there is considerable uncertainty regarding its accuracy (conifer and deciduous). Audit investigations for TSR1 were based on a small sample (not statistically valid). Timber supply forecasts are dependent on the quality of the inventory, as is development of a sound silvicultural strategy for the management unit.

Mixedwood Management Objectives - While there is currently little harvesting in mixedwoods, some "coniferous" sites are developing as mixedwoods. Outstanding issues include decision support regarding appropriate management for these sites, particularly reliable yield projections for the deciduous and coniferous components of the stands.

Regeneration Delay - Information is required to validate or correct current estimates of regeneration delay used in timber supply analysis.

Timber/Range Conflicts - Issues related to conflicts between timber management and range management require resolution. These include: quantification of the impact of range use on the THLB; the impact that cattle browsing has on growing stock density and potential yield in deciduous-leading stands; possible opportunities for reducing grazing damage to trees by improving the coordination of cattle management; and integrating aspen regeneration and grass-seeding.

Deciduous Land Base

Deciduous Timber Supply - The base case harvest forecast for the deciduous land base starts at the current AAC, and declines by about 10% per decade to the long-term harvest level.

Deciduous Yield Projection - There are concerns in the district about the accuracy of the deciduous inventory. As harvesting deciduous species increases in the near future, predicting yields for deciduous species will become more important.

Productivity Potential - There is inadequate information regarding site productivity potential of deciduous species.

2.7.2.2 TIMBER SUPPLY – QUALITY

The are no outstanding issues regarding timber quality in the Fort St. John TSA.

2.7.2.3 HABITAT SUPPLY

Natural Disturbance Regimes - The issues relating to fire disturbance regimes and forest management practice in the Fort St. John TSA is similar to that described for the Dawson Creek TSA.

Non Productive Cover Conversion - Areas of non-commercial brush (primarily willow and grass) are being converted to spruce. This often involves heavy reliance on herbicides to control vegetation competition. There may be detrimental effects on the presence and distribution of rare ecosystems.

Wildlife Habitat/Forestry Interaction - Common issues of concern to stakeholders concern the habitat requirements of red-listed species and furbearers, including the maintenance of critical habitat for grizzly bear. There is also uncertainty regarding the potential impacts of silvicultural systems on wildlife habitat

Caribou - The Fort St. John TSA includes four caribou management zones: Kobes Creek, Graham, Hackney Hills, and Milligan Hill. These areas comprise 1.8%, 3.3%, 4.0%, and 12.8% of the timber harvesting land base (THLB) respectively. The impacts of forest management on forage habitats for these herds is not well understood.

2.7.3 SILVICULTURAL PRACTICES

2.7.3.1 SILVICULTURAL HISTORY

Incremental silviculture has not been emphasized in the Fort St. John TSA. Since 1985, priority has been on eliminating NSR and brushing impeded stands.

2.7.3.2 BACKLOG SILVICULTURE

In TSR1, a total of 94 478 ha was classified as NSR in the inventory file, and 51 543 ha of this area was considered to be operable and added back to the THLB. The remaining 42 935 ha were assumed to be inoperable and the result of natural disturbances such as fires, wind, insects and disease.

There is uncertainty regarding the NSR backlog figures used in TSR1. Silvicultural records in 1996 suggested there was only 21 610 ha of NSR (10 875 created by logging, 10 735 ha originating from wildfire). In 1999 approximateoy 14 500 ha of NSR remained. Successfull reforestation of these remaining sites will depend on the availability of silvicultural herbicides.

Much of the fire-origin NSR remaining untreated will be reclassified through photo-interpretation, with undoubtably some areas being reclassified to productive forest status. Most will remain as open range, non-productive cover, or other non-forest classification

2.7.3.3 PRECOMMERCIAL THINNING

There is little or no precommercial thinning (juvenile spacing) done within Fort St. John TSA. Spruce stands are not considered to be candidates for spacing regardless of stocking density. Lodgepole pine stands will be considered for repression spacing only, where densities exceed the legislated maximum density of 10 000 sph, and preference is given to stands in which density exceeds 15 000 sph. In very dense stands a two-pass spacing system may be employed, involving first, mechanical row-thinning, followed by a motor-manual selection thinning. This approach is intended to promote optimum biological response with reduced overall thinning costs.

2.7.3.4 TREE IMPROVEMENT

No genetic gain has been included in either TSR1 or TSR 2, since nc class "A" seed will be available for the Fort St. John TSA until 2007. The projected gain from improved seed for the Prince George Region is shown in Table 2.5.1.

Table 2.5.1 Forecast gain in volume from improved seed for the Prince George Region.

Species & Seed Zone	Elevation (m)	Gain from Improved Seed (%) 98-99	99-00	2007-08
Sx PR low	<1200	-	-	23

Source: Forest Genetics Council

2.7.3.5 HERBICIDE USE

Use of forest herbicides is as contentious in Fort St. John TSA as it is in many other management units. Without the judicious use of selective herbicides, however, plantation silviculture would fail at the establishment phase, particularly in backlog NSR conversion.

2.7.4 TSR 1 MANAGEMENT ASSUMPTIONS

In addition to the inventory, assumptions about how it will be managed are essential for determining a silviculture strategy.

2.7.4.1 INVENTORY PROFILE

The inventory profile (species composition) of the THLB will change over time with harvesting and replanting. Table 2.5.3 records the trend in species profile resulting from the harvesting schedule of the TSR base case.

Table 2.5.3 Current inventory profile and conversion trends, Fort St. John TSA 1995

	Percent of area		
Species	**Total**	**Mature**[1]	**Conversion**
Pine	34	41	$P_{85} S_{15}$
Spruce	27	37	S_{100}, or $S_{75}P_{25}$
Aspen	37	38	A_{100}
Cottonwood	1	-	
Balsam	<1	-	
Total	**100**	**100**	

Source: TSR1 Fort St. John TSA Timber Supply Analysis, 1995

1. above minimum harvestable age

2.7.4.2 MANAGEMENT ZONES AND FOREST COVER REQUIREMENTS

The TSR management zones and their associated forest cover requirements are listed in Table 2.5.4 and the minimum harvest ages are summarized in Table 2.5.5.

Table 2.5.4 Management zones and forest cover requirements, Fort St. John TSA 1995

Management Zone		% THLB Area	Height 1 (m)	Age 1 (yr)	Maximum % area less than Height 1	Height 2 (m)	Age 2 (yr)	Minimum % area older than Age 2
1	Graham caribou habitat	3.3					140	40
2	Kobes Creek caribou habitat	1.8					120	40
3	Hackney Hills Caribou	4.0					100	40
4	Milligan Hills caribou habitat	12.8					40	50
5	VQO – Partial Retention	0.3	5		10			
6	IRM – coniferous	49[1]	3				100	10
7	IRM- deciduous	28[1]	3				80	30 (At)

1. IRM zone comprises 77% of coniferous and deciduous forests. This figure was adjusted *pro rata* using the coniferous (64%) and deciduous (36%) components of the THLB.

Source: TSR1 Fort St. John TSA Timber Supply Analysis 1995, pp 64-68.

2.7.4.3 HARVESTING PRACTICES

The average area harvested annually is about 2600 ha/year, all of it under even-aged silvicultural systems.

Table 2.5.5 Minimum harvestable ages by leading species and site class, Fort St. John TSA 1995

	Site:		
Species	**G**	**M**	**P**
B	80	80	130
S	80	100	130
Pl	70	80	100

Source: Fort St. John TSA Timber Supply Analysis 1995, p64.

2.7.5 TIMBER SUPPLY DYNAMICS AND THE AAC – CONIFEROUS GROWING STOCK

The 1995 TSR, upon which the current AAC determination was based, suggests that the coniferous timber supply in Fort St. John TSA is capable of supporting a non-declining harvest level of 1.76 million m^3/yr (Figure 2.5.3). This harvest level is 95% higher than the current AAC of 900 162 m^3/yr. The projected increase in the coniferous timber supply relative to the current AAC is due primarily to the inclusion of marginal pine stands previously not contributing to the timber supply.

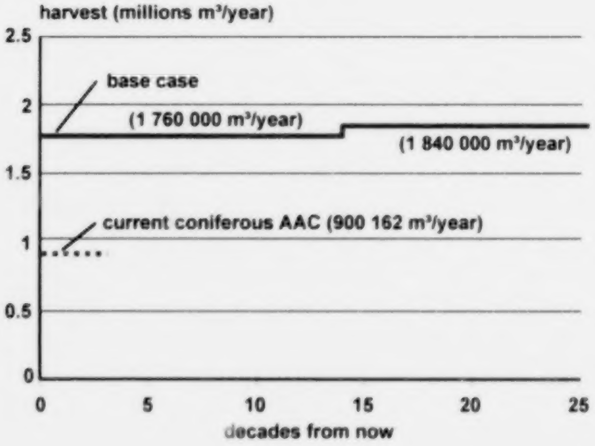


Figure 2.5.3 Coniferous base case harvest forecast, Ft. St. John TSA 1995

A significant portion of the existing coniferous forest is older than minimum harvestable age (Figure 2.5.1). There is currently a total of about 131.47 million m^3 of coniferous volume on the THLB, and of that, about 110.25 million m^3 (84%) is old enough for harvest (Figure 2.5.4). Both the total and harvestable timber inventory decline over the first 100 years before reaching a steady level. An even growing-stock level signifies that timber is being harvested at the productive capability of the land.

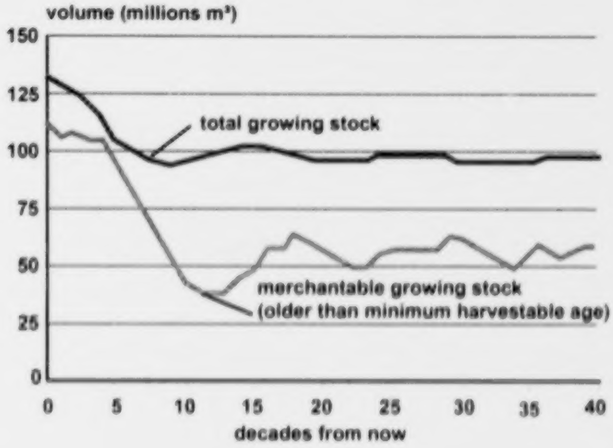


Figure 2.5.4 **Growing stock inventories, coniferous base case, Fort St. John TSA 1995**

The average age of stands harvested in the base case harvest forecast declines from about 175 years in the short term to about 100 years in the very long-term (Figure 2.5.6). Over the first 150 years, the harvest is taken almost exclusively from the older existing stands of timber. Regenerated stands are harvested near the minimum harvestable ages.

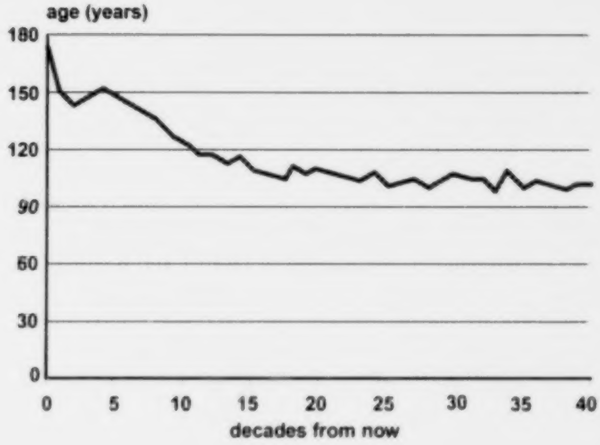
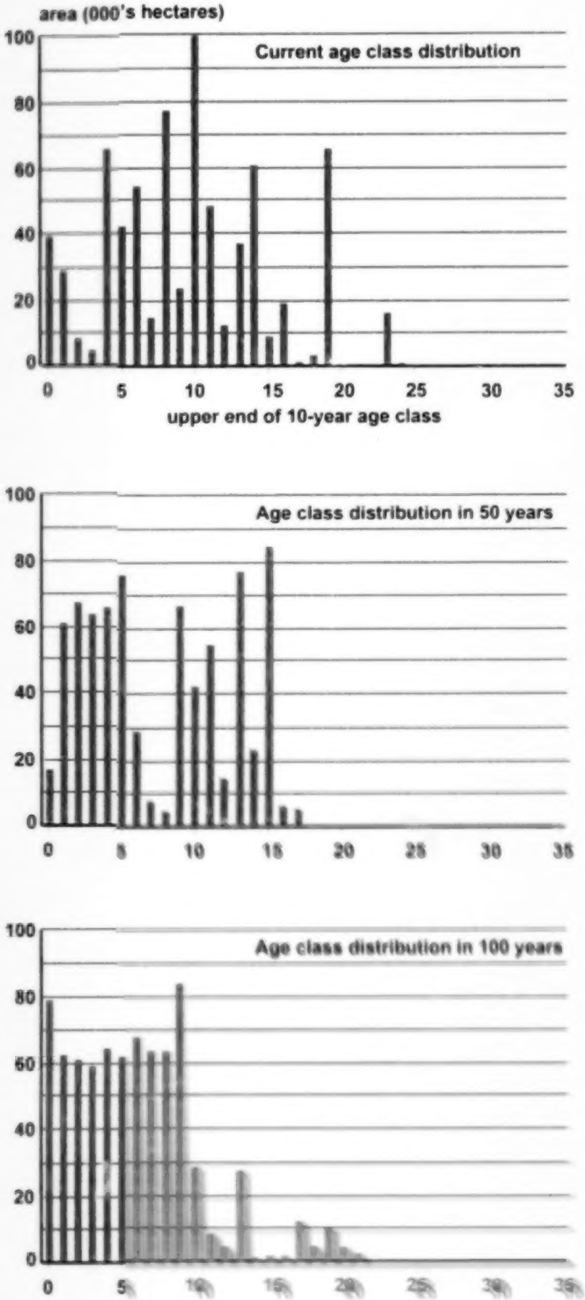


Figure 2.5.5 **Average age of harvested stands over time, coniferous base case, Fort St. John TSA.**

2.7.5.1 TRANSITION FROM NATURAL TO MANAGED STANDS

Figure 2.5.6 displays the age class distributions of the THLB today, in 50 years, and in 100 years. The majority of the current age class distribution ranges from 90 to 130 years. As this mature timber is harvested, younger age classes can mature, and regenerating harvested mature stands can develop until they reach or exceed minimum harvestable ages.

Figure 2.5.6 **Age class distribution over time, coniferous base case Fort St. John TSA**



2.7.5.2 NON-DECLINING HARVEST LEVEL EFFECTS

With the inclusion of additional land base (marginal pine stands) in the THLB, the harvest forecast can begin well above the pre-TSR1 AAC and still be non-declining. Without the non-declining harvest flow constraint, a higher harvest could be maintained in the short-term, with the long-term harvest level reached in about 140 years (Figure 2.5.7). This higher rate of harvest in the short term is achieved by harvesting the existing inventory of mature coniferous timber more rapidly than in the base case. The alternative harvest flow shows that a harvest of 2.15 million m^3/yr, approximately 22% higher than the base case harvest forecast, can be maintained for one decade. The dip below the base case harvest forecast in decade 10 is a result of the adjacency or old-growth forest cover requirements limiting the availability of stands for harvest.

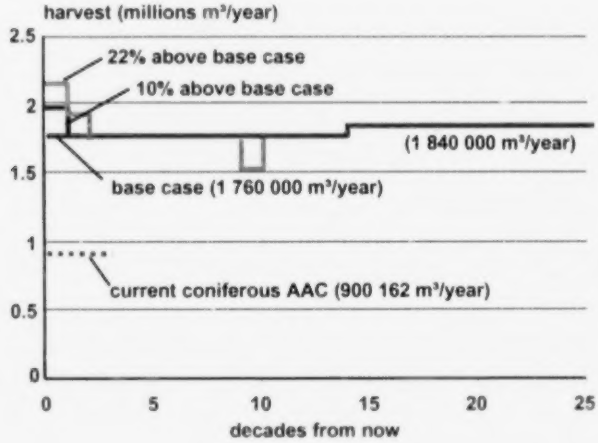


Figure 2.5.7 **Alternative harvest flows using the coniferous base case, Fort St. John TSA**

2.7.5.3 INCREASING STAND YIELDS

Changing existing-stand yields causes significant change in the initial harvest level (Figure 2.5.8). Changing the yields for regenerated stands has no effect on the initial harvest level.

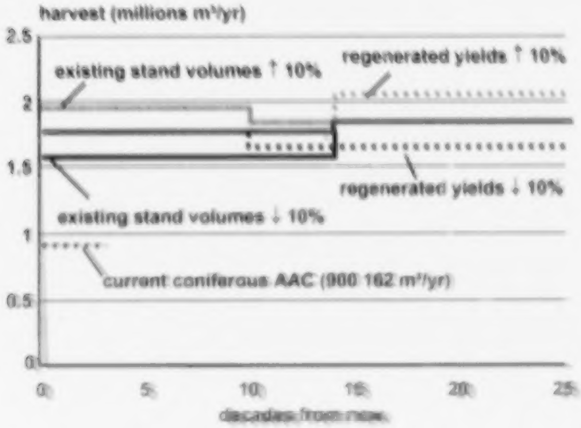


Figure 2.5.8 Coniferous harvest forecasts with stand yields changed by 10%

2.7.6 TIMBER SUPPLY DYNAMICS AND THE AAC – DECIDUOUS GROWING STOCK

The deciduous harvest forecast based on current forest management assumptions for the Fort St. John TSA indicates that the current AAC of 915 000 m^3/yr from deciduous stands can be maintained for 20 years. After that point the volume harvested must be reduced by 10% per decade (to 635 000 m^3/yr) to avoid severe drops below the long-term level (Figure 2.5.9).

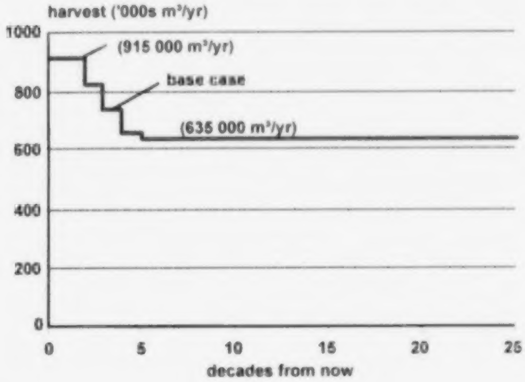
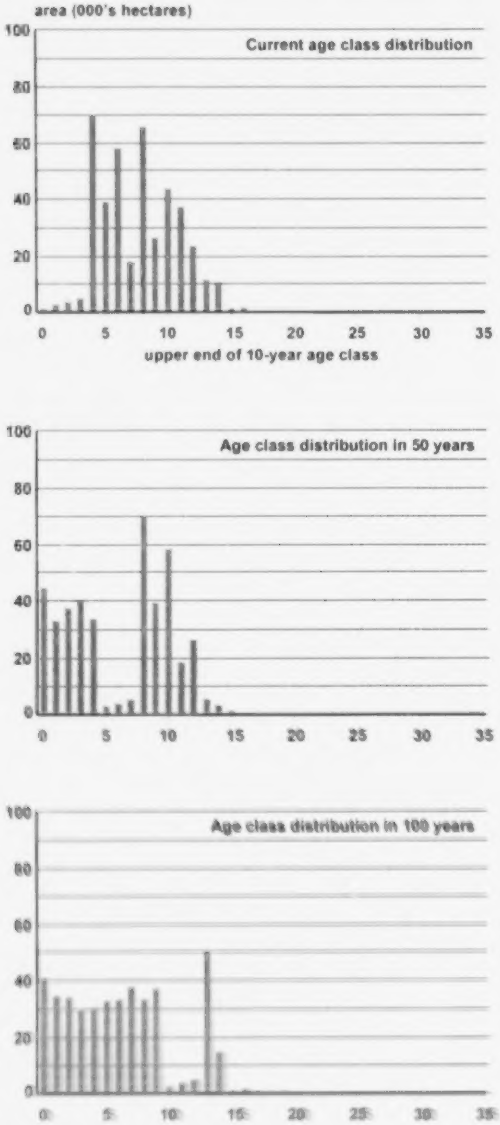


Figure 2.5.9 **Deciduous base harvest forecast, Fort St. John TSA**

2.7.6.1 TRANSITION FROM NATURAL TO MATURE STANDS

Figure 2.5.10 displays the deciduous age class distribution of the THLB currently, in 50 years, and in 100 years. Most of the area of deciduous forest is between 80 and 140 years old. At these ages aspen and cottonwood reach culmination of mean annual increment (MAI), and the incidence of decay increases significantly after about 120 years. Therefore, an important consideration in managing deciduous stands is to harvest older stands before significant volumes are lost to decay.

Figure 2.5.10 **Stand age class distribution over time, deciduous base case Fort St. John TSA 1995**



2.7.6.2 SCARCITY OF HARVESTABLE TIMBER IN LATE MID-TERM

Figure 2.5.11 illustrates the gradual decline in the available growing stock for the first 50 years.

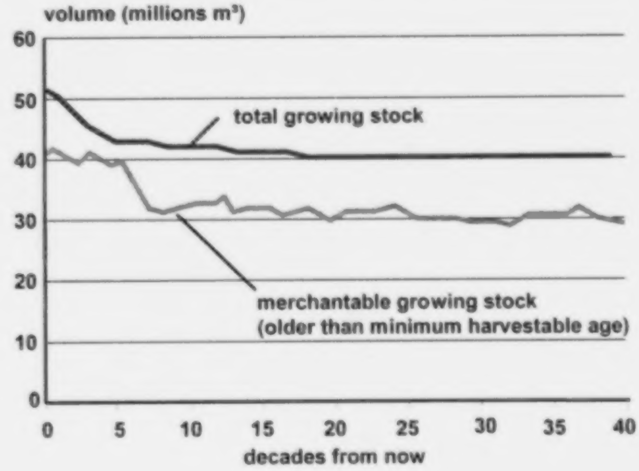


Figure 2.5.11 **Total and available growing stock, deciduous base case, Fort St. John TSA 1995**

2.7.6.3 RATIONING OF CURRENT MATURE TIMBER

Figure 2.5.12 shows alternative harvest flows that ration out the stock of existing mature timber at different rates than in the base case. In the first alternative harvest flow, the initial harvest is 9% higher than in the base case forecast, but declines slightly more steeply. The reason for this decline is the depletion of mature harvestable stands before regenerating stands have reached the minimum harvestable age. The harvest level evens out as the balance between regenerating and mature stands is reached.

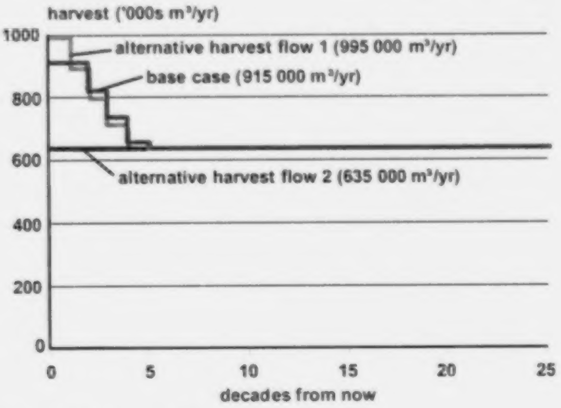


Figure 2.5.12 **Alternative harvest flows using the deciduous base case, Fort St. John TSA**

2.7.6.4 INCREASING STAND YIELDS

Figure 2.5.13 shows the effect on the deciduous harvest forecast of increasing stand volumes for existing and regenerated stands by 10% (the same yield tables were used for existing and regenerated stands). The current allowable harvest level can be maintained for 30 years then declines by 10% per decade to the long term harvest level. If the stand volumes are decreased by

10%, the initial harvest level is decreased and declines after the first decade by 10% per decade to the long term harvest level.

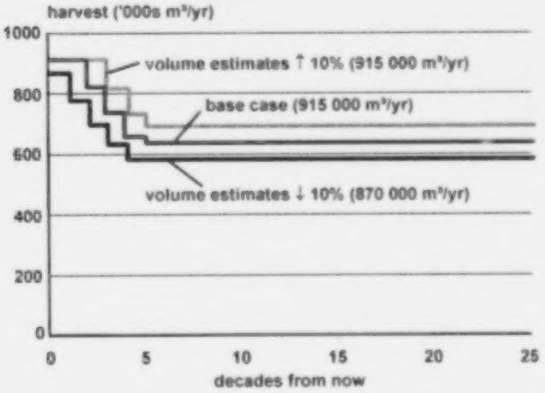


Figure 2.5.13 Deciduous harvest forecast with yield estimates +/- 10%

INCREASING THE TIMBER HARVESTING LAND BASE

A review of 280 sample plots used to calibrate Variable Density Yield Prediction (VDYP) may be underestimated by an average of 15% due to decay, waste and breakage factors. The THLB could be larger; fewer stands would be deducted due to low site productivity or volume. Figure 2.5.14 examines the effects of increasing both volume and land base.

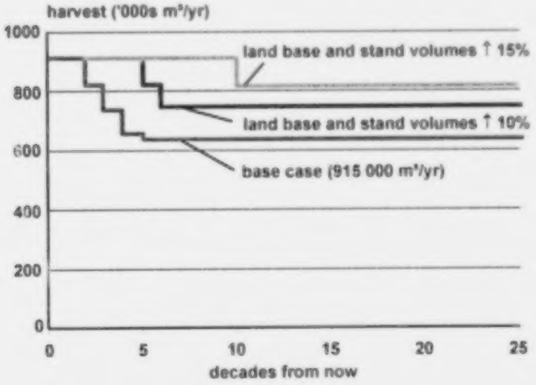


Figure 2.5.14 Deciduous harvest forecast with volume estimates and land base increased by 10% and 15%

2.7.7 TIMBER SUPPLY DYNAMICS - SUMMARY

The Fort St. John TSA is separated into coniferous and deciduous components for timber supply analysis and AAC determination. The harvest forecast for the coniferous forest is flat, indicating that there is little harvesting pressure on the unit in the short term, and that the abundance of existing mature timber buffers the harvest forecast against changes in data or assumptions. This means that there aren't many opportunities for manipulating timber supply by applying silvicultural activities. Neither changing minimum harvestable age (MHA) nor increasing yields for regenerated stands has any short-term effect on timber supply.

Timber supply on the coniferous forest is sensitive to changes in the THLB, about which there are two sources of uncertainty. First is the inclusion of a large area of marginal (small) pine stands. There is some question about how much of these pine stands are truly merchantable. Secondly, there is a significant amount of backlog NSR that was scheduled for rehabilitation in TSR1. There is uncertainty about how much of this backlog can be successfully rehabilitated on the one hand, and how much might be incorrectly classified on the other hand. If the use of herbicides is curtailed, rehabilitation of NSR will be more challenging, and regenerating high site index coniferous stands to pure conifer may be difficult or impossible.

The base case forecast for the deciduous forest shows that the current AAC can be maintained for only two decades, after which it must decline by 30% over four decades to the long-term harvest level. The short-term deciduous harvest was slightly sensitive to two factors: yields for existing and regenerated stands, and regeneration delay. It may be possible to define some silvicultural strategies to utilize this sensitivity to affect short-term harvest levels. However it is only recently that the actual level of harvesting in the TSA is approaching the supply forecast levels.

2.7.8 KEY ISSUES AND POTENTIAL SILVICULTURAL STRATEGIES

This section identifies the key Sustainable Harvest issues facing the TSA, as well as potential silvicultural strategies considered suitable to address them. Of those resource supply issues described in Section 2.5.2, two are considered key by management unit stakeholders:

- How can the coniferous and deciduous timber harvesting land base be expanded or maintained in the TSA?
- How can the expected fall down in the decidous harvest be mitigated?

Both these issues are directly addressable through specific silvicultural strategies and tactics, summarized, with relative stakeholder priority, in Table 2.5.6.

Table 2.5.6 Key issues and possible silvicultural strategies and tactics for the Fort St. John TSA.

Key Issues	Silvicultural Strategies	Silvicultural Tactics	Opportunity Area (ha/yr)	Stakeholder Priority
Maintain or Enhance the THLB	NSR Reclassification	photo interpretation	10 000	1
		ground surveys	2000	1
	NSR Reforestation	site preparation	200	1
		planting	400	1
		manual brushing	900	1
		herbicide brushing	400	1
		surveying	1600	1
	Surveys	low productivity sites	?	2
		non-merchantable stand types	?	2
		NC Br (recce survey)	200	3
		old oil and gas roads and well sites	400	4
Mitigate Fall-down of Deciduous Harvest	Aspen management	fill-plant, or herbicide/plant improved aspen genotypes	250	5

The forest level impacts of each stategy and tactic are estimated in Table 2.5.7. This set of strategies must be considered provisional at this time; they must be analysed and evaluated in further forest estate modelling. Most importantly, the resource inventory on which they are based must be updated to ensure the current state of the forest is accurately described. If this is not done, apparent issues and possible strategic solutions could be misleading. In the meantime, and for this RMP, local technical expertise, current policies and present uncertainties surrounding some of the following strategies are reflected in the SH investment recommendations for the Fort St. John District.

2.7.8.1 ISSUE 1: MAINTAIN OR EXPAND THE TIMBER HARVESTING LANDBASE

STRATEGY 1-1 RETIRE NSR BACKLOG

Possible Tactics

Identify NSR versus non-NSR, using photo interpretation in concert with ground-truthing.

Classify NSR that is deciduous leading.

Reforest stands that require it. Check stocking of deciduous-leading stands–where adequately stocked, consider shifting the block to a deciduous polygon for future timber supply analyses.

Target Stands

Stands currently classified as NSR in ISIS, both harvested and otherwise.

Expected Forest Level Benefit

This will maintain the landbase currently assumed in the (base case projections depends upon it).

Presently there is no falldown indicated for the coniferous timber supply, yet one is indicated for the deciduous timber supply (assuming the cut is achieved in the short-term). Accepting NSR stands stocked with deciduous species would increase the deciduous supply and decrease coniferous supply in the mid-term and long-term.

STRATEGY 1-2 INCREASE THE TIMBER HARVEST LANDBASE THROUGH CONVERSION OF OLD AGRICULTURAL LAND

Possible Tactics

To implement this strategy there needs to be an agreement with Crown Lands over jurisdiction. A paper describing the benefits of afforestation or range use is needed. The justification of including the land in the THLB could be in the form of jobs or animal unit months (AUMs).

Target Stands

Crown lands within the TSA.

Table 2.5.7 Key Issues, possible strategies and potential tactics with forest level impacts, Fort St. John TSA

	Issues	Objectives	Strategies	Target	Activities	Opportunity Area (Ha/Yr)	Timber Supply Effects Short	Mid	Long	Qual	Habitat Effects	Jobs Days/ha	Cost $/ha	Rank
1	Maintain or increase timber harvesting land base	Retire backlog NSR	identify NSR/non-NSR	Area currently classified NSR on FC1	Photo interpretation reclassification - false color IR	10000		+	+	0				1
			classify NSR (decid-leading, conifer-leading, productivity)	NSR in ISIS database	- ground surveys	2000		+	+				36	1
			reforest backlog NSR	harvested NSR in ISIS	site prep	200		+	+		+/-		1000	1
					plant	400		+	+		+/-		900	1
					manual brushing	900		+	+		+/-		860	1
					herbicide brushing	400					+/-		400	1
					survey	1600		+	+		+/-		36	1
2		Manage abandoned agricultural land	afforest old agricultural land - substitute lands for range use	Crown lands in TSA - ALR lands that have reverted to Crown	- pursue agreement with Crown Lands - identify old agricultural land suitable for afforestation or range use	250		+	+		+/-		4	3
3		Afforest oil and gas lands	afforest oil and gas access roads, facilities, and well sites that are no longer used	oil industry roads and well sites	- identify lands from Oil and Gas Commission database - survey, determine total treatable area	800		+	+		+		4	4
					prep and plant	400		+	+		+		3500	
4		Utilize "low productivity" lands	Classify "low productivity" lands as treatable, non-treatable, not "low", utilize productive sites	area classified as "Low Productivity"	identify area in FC1 (check TSR criteria) - survey - classify	?		+	+					2
			Classify non-merchantable stands	area classified as "non-merchantable"	identify area in FC1 (check TSR criteria) - survey - classify	?		+	+					2
					treat	0, 300, 300		+	+		+/-		3186	2
5		Utilize "low productivity" lands	Assess and treat NC Br	areas of NC Br accessed since FRDA conversions (e.g., Tommy Lakes)	- recce survey - landscape-level plans -select areas for treatment	200		+	+		+/-		4	3
6	Falldown in deciduous harvest forecast	Mitigate deciduous harvest falldown	Classification of deciduous stands recognizing differences btwn aspen clones	aspen-leading stands across TSA within 150 km of Fort St John	- tools/decision tree to assess individual stand - aging and assessing - design management regimes for different classes of aspen clone - assess timber supply implications	within 150 km of Fort St. John	+	+	+				10	3
					harvest stands that are decaying and below present MHA	<250 ha	+				+/-			
			Use artificial regeneration techniques for aspen	harvested areas with inadequate aspen re-stocking	- further development of stock types, nursery procedures - developing site-specific prescriptions for establishment	<250 ha		+	+	+	+/-			5
				areas harvested in 6, above	fill-plant, or herbicide and plant to establish improved genotype on site	<250 ha		+	+	+	+/-		1800	5

KEY TO RANKS

1 NSR is highest priority because base case depends on it
2 items that contribute to land base immediately were given high priority
3 bringing non-contributing lands into THLB
4 dispersed, high cost, questionable return on investment
5 long-term benefits

Expected Forest Level Benefit

Bring more land into the THLB to increase harvest levels in the long term, and potentially in the short- and mid-term, depending upon the status of the land–some hectares may be presently stocked with merchantable or nearly merchantable deciduous stems.

STRATEGY 1-3 AFFORESTATION OF OIL AND GAS INDUSTRY ACCESS ROADS, FACILITIES AND WELL SITES THAT ARE NO LONGER IN USE

Possible Tactics

Create treatment regimes based on present status (cover and history). Identify potential areas, survey to determine total treatable area and treat accordingly.

Target Stands

Suitable lands from Oil and Gas Commission database.

Expected Forest Level Benefit

Bring more land into the THLB to increase harvest levels in the long and potentially short and mid term, depending upon the status of the land (some may be stocked with merchantable or nearly merchantable deciduous).

STRATEGY 1-4 CLASSIFY "LOW PRODUCTIVITY" LANDS AS TREATABLE, NON-TREATABLE AND NOT "LOW"

Possible Tactics

Bring not-low hectares back into the THLB, treat treatable lands where appropriate, update the inventory with accurate figures for "low-productivity" and non-treatable "low productivity" lands.

Identify potential areas, survey to determine total treatable area and treat accordingly. This will require a comprehensive sampling methodology (some 275,000 ha to assess), a set of criteria for "low productivity", a set of criteria for "treatable", a set of regimes appropriate for "treatable" sites and a mechanism to update the database with the revised values. Once the treatable area and the regimes have been identified, the impact of treatment and desirability of implementing the plan can be determined based on the forest-level effects

Target Stands

Areas classified presently as "low productivity". Identify areas in FC1. Use most recent TSR to check for criteria for "low productivity".

Expected Forest Level Benefit

Bring more land into the THLB to increase harvest levels in the short-, mid- and long-term.

STRATEGY 1-5 RECLASSIFY STATUS OF NON-MERCHANTABLE STANDS

Possible Tactics

Create classes to better define merchantability, i.e., volume categories (e.g., > 140 m^3/ha, 100 to 140 m^3/ha, 70 to 100 m^3/ha, < 70 m^3/ha or some sliding scale organized by distance to processing locations - less volumes closer to center).

Identify non-merchantable polygons in the inventory. Sampling will require a comprehensive sampling methodology (some 306,000 ha to assess), a set of criteria for non-merchantable (or categories as described above needs to be created) along with a mechanism to update the database with the revised values.

Target Stands

Areas classified as non-merchantable. Identify areas in FC1. Use most recent TSR to check for criteria for "non-merchantable".

Expected Forest Level Benefit

Bring more land into the THLB to increase harvest levels in the short-, mid- and long-term.

STRATEGY 1-6 CLASSIFY AND TREAT SUITABLE NC BRUSH (NC BR)

Possible Tactics

Identify potential areas, survey to determine total treatable area and treat accordingly.

Target Stands

Areas of NC Brush in newly roaded (last 5 years) areas. Target areas not available during FRDA period (e.g., Tommy Lakes).

Expected Forest Level Benefit

Bring more land into the THLB to increase harvest levels in the long term.

2.7.9 ISSUE 2: FALLDOWN IN DECIDUOUS HARVEST FORECAST

STRATEGY 2-1 IMPROVE DECIDUOUS INVENTORY AND PRODUCTIVITY

Possible Tactics

The present accuracy of the deciduous inventory is uncertain. Audit investigations for TSR 1 were based on too small a sample size to be statistically valid. Therefore a larger sample size is needed to provide accurate deciduous volume estimates.

While TSR 1 did not indicate a problem with site index estimates, there is uncertainty regarding deciduous productivity estimates. It is suggested that productivity be estimated at the time of field sampling. An example methodology is described by Chen et al (1998[12]) to assess aspen productivity based on ecological factors.

Target Stands

Within 150 km of Ft. St. John.

Expected Forest Level Benefit

More accurate volume estimates and growth potential for aspen leading stands. Better forecasting for deciduous timber harvest.

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[12] Chen, H.Y.H., K. Klinka and R. Kabzems. 1998. Site index, site quality, and foliar nutrients of trembling aspen: relationships and predictions. Can. J. For. Res. 28: 1743-1755.

STRATEGY 2-2 EXPLORE MIXEDWOOD MANAGEMENT

Possible Tactics

Follow-up with present strategies and research initiatives such as those being explored in the Fort Nelson TSA and elsewhere (e.g., Alberta). Beware of the limitations of present information when modeling mixedwood treatments. Additional field study, operational trials, and adaptive experimental management are needed to determine suitable options for mixed wood management[13].

Propose and implement suitable mixedwood harvesting strategies in the TSA, monitor results. Work with modelers to help assess timber supply implications.

Target Stands

Within 150 km of Ft. St. John.

Expected Forest Level Benefit

Use of existing mixedwood structures to utilize both deciduous and conifer volumes. Studies have shown significant spruce release after aspen overstorey removal[14]. Possible increase to deciduous long term harvest level, depending upon implementation.

STRATEGY 2-3 DESIGN MANAGEMENT STRATEGIES BASED ON CLONE PRODUCTIVITY. EXAMINE THE SUITABILITY OF THE MINIMUM HARVEST AGE AS BEING USED IN THE TSR.

Possible Tactics

Through updated inventory information identify "underachieving" clones. Where clones are not well suited to the site (i.e., early rot), harvest prior to the minimum harvest age (MHA) to capture present volume. To increase the productivity of these sites artificial reforestation (either aspen or conifers) should be considered.

Target Stands

Within 150 km of Ft. St. John (decaying stands that are below the MHA).

Expected Forest Level Benefit

Utilize present volumes before additional decay reduces their volume and value further. Reforest with suitable stock to promote better site utilization.

STRATEGY 2-4 REFINE ARTIFICIAL REGENERATION TECHNIQUES FOR ASPEN

Possible Tactics

Further development of stock types and nursery procedures is required. Development of site-specific regeneration prescriptions (e.g., density, microsite location) is also needed.

Explore aspen fertilization (watching for understory effects versus aspen response).

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[13] Barrie Phillips memo to the Chief Forester Regarding: Slocan FRBC Project Report "Forest Estate Planning in the Boreal Mixedwood:. October 8, 1999.

[14] Yang, R.C. 1991. Growth of white spruce following release from aspen competition: 35 year results. For. Chron. Vol. 67. No. 6, 706-711.

Man, R. and V. J. Lieffers. 1999. Are mixtures of aspen and white spruce more productive than single species stands? Forestry Chronicle, Vol. 75, No. 3, 505-513.

Target Stands

Within 150 km of Ft. St. John (decaying stands that are below the MHA).

Expected Forest Level Benefit

Reforest aspen in areas of poor quality clones. Allow more flexibility in reforestation of aspen and increase future aspen quantity and quality.

The forest level impacts of each stategy and tactic are estimated in Table 2.4.9. This set of strategies must be considered provisional at this time; they must be analysed and evaluated in further forest estate modelling. Local technical expertise, current policies and present uncertainties surrounding some of the following strategies are reflected in the SH investment recommendations.

2.7.9.1 RECOMMENDED KNOWLEDGE STRATEGIES

There are many related TSA silvicultural issues not directly addressable via silvicultural practices. Many of these require investigation and further study. Table 2.2.10 identifies, and ranks the importance of 9 Sustainable Harvest knowledge gap issues. These issues and knowledge gaps are discussed subsequently

1. UPGRADE FOREST INVENTORIES

There are concerns regarding the accuracy of the forest inventory, and in particular about the estimates of deciduous volumes. Audit investigations for TSR1 were based on a small sample (not statistically valid). Timber supply forecasts are dependent on the quality of the inventory. Undertaking a pre-inventory analysis (PIA) to assess the current inventory is recommended as a first step.

2. EXPLORE REGENERATION DELAY

Some empirical data is needed to validate or correct current estimates of regeneration delay used in timber supply analysis.

3. REFOREST AND MAINTAIN STOCKING OF BACKLOG

There is some uncertainty, or lack of confidence that reforested backlog hectares will remain adequately stocked. Survey evidence is needed.

Table 2.5.8 Issues requiring further investigation, Fort St. John TSA

Item	Issue requiring further investigation	Rank
1	Upgrade forest inventories (investment strategy depends on it, as do future timber supply analyses); begin with Pre-Inventory Analysis	1
2	Explore regeneration delay	1
3	Reforest and maintain stocking of backlog	2
4	Improve prediction of future yields	3
5	Improve decay, waste and breakage factors	4
6	Understand habitat requirements for: red-listed species (e.g., warblers), furbearers,	4
7	Develop strategies about impacts of silvicultural systems on wildlife habitat	5
8	Develop mixedwood management strategy	6
9	Quantify the impact of range use on THLB and timber supply	7
10	Improve range/cattle management	7
11	Minimize tree-grass-cattle conflicts through IRM	7
12	Integrated aspen regeneration and agronomic seeding—include input from licensees and MELP	7
13	Look into findings of 1999 grizzly bear study	8
14	Develop artificial regeneration techniques for aspen	9
15	Explore effect of fertilizing aspen	10

4. PREDICTION OF FUTURE YIELDS

There is a noticeable lack of information about the productivity of deciduous stands, and about estimates of site productivity for deciduous species. It may be possible to estimate site productivity for aspen using an approach based on ecological factors (e.g., Chen *et al*, 1998[15]).

5. WILDLIFE HABITAT

There is a need for better information regarding the habitat requirements of red-listed species, furbearers, Grizzly Bear and Caribou, and the impacts of forest management practices on these species.

6. DEVELOP MIXEDWOOD MANAGEMENT STRATEGY

While there is little harvesting in mixedwoods today, some “coniferous” sites are developing as mixedwoods. Issues include appropriate management for these sites, and developing yield projections for the deciduous and coniferous components of the stands. Follow-up with present strategies and research initiatives such as those being explored in the Fort Nelson TSA and elsewhere (e.g., Alberta). Additional field study, operational trials, and adaptive management experiments are needed to determine suitable options for mixed wood management[16]. Some studies have shown significant spruce release after aspen overstorey removal (e.g., Yang, R.C. 1991, Man and Lieffers, 1999[17]).

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[15] Chen, H.Y.H., K. Klinka and R. Kabzems. 1998. Site index, site quality, and foliar nutrients of trembling aspen: relationships and predictions. Can. J. For. Res. 28: 1743-1755.

[16] Barrie Phillips memo to the Chief Forester Regarding: Slocan FRBC Project Report "Forest Estate Planning in the Boreal Mixedwood:. October 8, 1999.

[17] Yang, R.C. 1991. Growth of white spruce following release from aspen competition: 35 year results. For. Chron. Vol. 67. No. 6, 706-711.

7. CONFLICTS BETWEEN TIMBER AND RANGE MANAGEMENT

A number of issues related to conflicts between timber management and range management were identified as needing investigation. These include quantifying the impact of range use on the THLB and the browsing effect on stocking density and potential yield in deciduous-leading stands; possible opportunities for reducing grazing damage to trees by improving the coordination of cattle management; and integrating aspen regeneration and grass-seeding.

Man, R. and V. J. Lieffers. 1999. Are mixtures of aspen and white spruce more productive than single species stands? Forestry Chronicle, Vol. 75, No. 3, 505-513.

2.7.10 MANAGEMENT UNIT SUSTAINABLE HARVEST PLAN – 2002-2007

2.7.10.1 ENHANCED FORESTRY PROGRAM

Activities	Treatment Area Goals (ha)					Plan 2002/03	
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Surveys	0	0	0	0	0	0.00	0
Spacing	0	0	0	0	0	0.00	0
Pruning	0	0	0	0	0	0.00	0
Fertilizing	0	0	0	0	0	0.00	0
Other	0	0	0	0	0	0.00	0
Totals hectares	0	0	0	0	0	0.00	0
Planning and prescriptions							0
Total dollars							0
Forest Health Enhancement							
Spacing	0	0	0	0	0	0.00	0
Pruning	0	0	0	0	0	0.00	0
Other treatments	0	0	0	0	0	0.00	0
Totals hectares	0	0	0	0	0	0.00	0
Habitat Supply and Biodiversity Enhancement							
Treatments	0	0	0	0	0	0.00	0
Domestic Range							
Treatments	0	0	0	0	0	0.00	0
Enhanced Forestry Activities - Management Unit Total							
Surveys	0	0	0	0	0	0.00	0
Spacing	0	0	0	0	0	0.00	0
Pruning	0	0	0	0	0	0.00	0
Fertilizing	0	0	0	0	0	0.00	0
Other stand tending activities	0	0	0	0	0	0.00	0
Totals hectares	0	0	0	0	0	0.00	0
Planning and prescriptions							0
Studies funding							0
Total dollars							0

2.7.10.2 BACKLOG FORESTRY PROGRAM

Activities	Treatment Area Goals (ha)					Plan 2002/03	
Legal Obligations	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Surveys	1740	1740	1740	1740	1740	25.86	45000
Site preparation	0	0	0	0	0	0.00	0
Planting	0	0	0	0	0	0.00	0
Brushing	200	200	200	200	200	400.00	80000
Max. density spacing	0	0	0	0	0	0.00	0
Totals hectares	1940	1940	1940	1940	1940	64.43	125,000
Seed purchase	0	0	0	0	0	0.00	0
Total legal obligations							125,000
Backlog Reforestation							
Surveys	2880	2880	2880	2880	2880	26.04	75000
Site preparation	1000	1000	1000	1000	1000	336.29	336290
Planting	1000	1000	1000	1000	1000	285.00	285000
Brushing	0	0	0	0	0	0.00	0
Totals hectares	4880	4880	4880	4880	4880	142.68	696,290
Seed purchase	1000	1000	1000	1000	1000	360.00	360,000
Prescriptions and planning dollars							25,000
Total backlog reforestation							1,081,290
Impeded areas							
Surveys	2880	2880	2880	2880	2880	26.04	75000
Brushing	1815	1815	1815	1815	1815	650.14	1180000
Density spacing	0	0	0	0	0	0.00	0
Totals hectares	4695	4695	4695	4695	4695	267.31	1,255,000
Prescriptions and planning dollars							25,000
Total impeded areas							1,280,000
Site Restoration							
Fill planting	0	0	0	0	0	0.00	0
Rehabilitation	0	0	0	0	0	0.00	0
Reforestation	0	0	0	0	0	0.00	0
Totals hectares	0	0	0	0	0	0.00	0
Seed purchase	0	0	0	0	0	0.00	0
Prescriptions and planning dollars							0
Total site restoration							0
Backlog Program Activities - Management Unit Total							
Surveys	7500	7500	7500	7500	7500	26.00	195000
Site preparation	1000	1000	1000	1000	1000	336.29	336290
Planting	1000	1000	1000	1000	1000	285.00	285000
Brushing	2015	2015	2015	2015	2015	625.31	1260000
Density spacing	0	0	0	0	0	0.00	0
Totals hectares	11515	11515	11515	11515	11515	180.31	2076290
Seed purchase	1000	1000	1000	1000	1000	360.00	360000
Prescriptions and planning							50,000
Recommended studies							0
Total backlog program							2,486,290

2.7.10.3 MANAGEMENT UNIT FRBC PERFORMANCE

	Performance Measure	Tree Improve-ment	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
	Inputs											
A	**Planned treatment area (ha) in 2001/2002**	1,000	0	940	1,000	1,000	2,015	0	0	0	5,955	
1.0	**Timber Supply**											
1.1	Potential volume/ha gain (m3/ha/yr)	0.34	0	0.25	0	1.9	0.25	0	0	0.40		
1.2	Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3	Pot. total merch. volume increment in 65 years (m3)	22,100	0	15,275	0	123,500	32,744	0	0	0		**193,619**
1.4	Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4	Est. area that will be reclassified as stocked (ha)			750								**750**
1.5	Est. area that will be declared as free growing (ha)			1,875								**1,875**
2.0	**Wood Value**											
2.1	Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0	**Employment**											
3.1	Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	2	2.61	3.96	4.54	0.18	0.1	
3.2	Estimated total employment (person days/year)	100	0	94	950	2,000	5,259	0	0	0	596	
3.3	Estimated total full time equivalent positions (FTE)	1	0	1	5	11	29	0	0	0	3	**50**
4.1	**Forest Health Enhancement (ha)**											**0**
5.1	**Habitat Supply**											
5.2	Planned area for specific wildlife forage or habitat creation in 2001/2002 (ha)											**0**
5.3	Est. area with secondary value provided to biodiversity (ha)											**0**

2.7.10.4 MANAGEMENT UNIT SUMMARY TABLE

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	0	0	0	0	0	0	0
Planning, prescriptions and seedlings							0
Backlog Program Field Activities	11,515	11,515	11,515	11,515	11,515	180	2,076,290
Planning, prescriptions and seedlings	100,000	100,000	100,000	100,000	100,000		100,000
Totals	11,515	11,515	11,515	11,515	11,515		2,176,290

Performance Measures

Potential total merchentable volume increment in 65 years	193,619 m^3
Estimated ha that will be reclassified as stocked	750 ha
Estimated ha that will be declared as free growing	1,875 ha
Estimated total full time equivalent positions generated	50 FTEs
Forest health enhancement area	0 ha
Planned area for specific wildlife forage or habitat creation	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

2.8 FORT NELSON TSA SUSTAINABLE HARVEST ISSUES AND SILVICULTURAL STRATEGY

This section describes the key sustainable harvest issues in the Fort Nelson TSA, and defines a provisional silvicultural strategy to address them. The following strategic analysis is based on a recently completed Type I Silvicultural Analysis, but requires further, detailed forest analysis and modelling in the Type II analysis. In the meantime, this provisional strategy is reflected in the proposed, 5 year Sustainable Harvest Plan for the Fort Nelson Forest District (Section 2.8).

2.8.1 THE RESOURCE LAND BASE

The Fort Nelson Timber Supply Area is the second largest timber supply area in the province, covering more than 9.7 million hectares. It is bordered on the east by Alberta, on the north by the Northwest and Yukon Territories, on the west by the summit of the northern Rocky Mountains and the Bulkley/Cassiar Forest District, and on the south by the Fort St. John and Mackenzie Forest Districts.

The eastern part of the timber supply area, nearest the Alberta border, is an extension of the Great Plains (or Alberta Plateau). In the southern part of the timber supply area, these plains grade into the foothills of the northern Rocky Mountains at the western boundary of the timber supply area. In the northern portion, the plains grade into the Liard River basin and the Liard Plateau.

The TSA boundary has been recently amended, adding about 1.5 million hectares which was previously part of the Cassiar TSA, will be added to the Fort Nelson TSA. The area added to the Fort Nelson TSA is remote and not expected to contribute significantly to timber supply over the next several years. However, it will contribute to other resource values of the Fort Nelson TSA. The contribution of the additional area and its impact on the Fort Nelson TSA timber supply, if any, will be examined in the next timber supply review.

Approximately half of the Fort Nelson TSA is considered productive forest area (about 4.2 million hectares). Currently 28% of that productive forest is considered available for harvesting.

The site class profile of the timber harvesting land base is: 35% poor, 54% medium, 9% good site, and 1% low productive site (RMP).

The current age class distribution of the Fort Nelson TSA forest land base is illustrated in Figure 2.6.1. Within the timber harvesting land base, a substantial portion of stands are in mature (28%) or old (36%) seral stages. About 6% of stands are early seral, reflecting the frequent fire disturbance of the TSA.

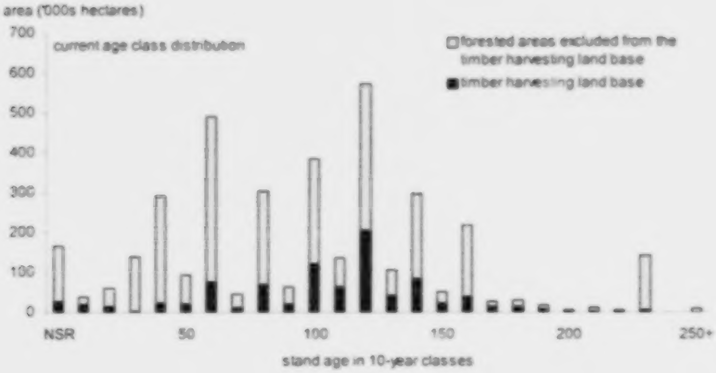

Figure 2.5.1 **Age class distribution in the Fort Nelson TSA.**

The tree species distribution in the TSA is apprriximately 43% white spruce, 20% Lodgepole pine, 29% aspen, 5% birch and 3% cottonwood.

2.8.2 RESOURCE SUPPLY ISSUES

2.8.2.1 TIMBER SUPPLY – VOLUME

Mixedwood Management Guidelines - Mixed species stands have not been widely utilized in the Fort Nelson TSA. Development of coniferous and deciduous facilities in Fort Nelson has led to increased interest in mixedwood stands. The District has developed an interm mixedwood strategy but there is uncertainty about the dynamics of mixedwood stands. Silviculture stand management techniques for mixedwood stands are currently under development.

Potential Productivity Losses on Backlog Sites - ISIS currently lists 11,000 ha of backlog NSR. Of this, approximately 2,500 are deemed untreatable due to regeneration problems or other constraints, and a further 2,500 ha are known or estimated to be stocked. There remains approximately 6,000 ha to be treated, spread out in a mosaic pattern over the entire THLB. It is estimated that 30% will be mechanically site prepared and planted, and 70% will be chemically site prepared and planted. Assuming an average cost of $1600/ha to site prepare and plant these areas, the total budget to complete this work is estimated at $9.6 million.

In addition to Backlog NSR reforestation needs, many stocked backlog stands require vegetation management. For the entire area of backlog (30 000 ha) it is estimated that 25% needs no treatment, 60% need one brushing treatment, and 15% needs two brushing treatments. It is also assumed that 70% of brushing treatments will use herbicides, while the other 30% will be manual. Given two treatments on some areas, and the need for brushing maintenance on regenerated NSR stands, it is estimated that 25 800 ha of treatment is required for full achievement of free growing on all backlog sites. Assuming $400/ha for chemical treatments and $1400/ha for manual treatments, the total budget required for brushing backlog areas is anticipated to be $25.8 million.

Small Scale Salvage Program - The estimated annual loss (TSR) to Spruce beetle, Spruce budworm, and fire on the total land base is 484 569 m^3 per year. Annual salvage of this lost amount is 58 173 m^3 per year. Blowdown loss in mature stands needs to be estimated. Development of a substantial salvage program would increase timber supply

Budworm Infestation - Many stands, including young plantations, mixedwood stands, and pure spruce stands in this TSA were heavily attacked by budworm during the last 10 years. It was estimated that 1.1 million hectares was affected by a 1999 attack. Improved forest health maintenance projects and increased salvage programs could potentially increase timber supply.

Incremental Silviculture - Due to the late start of harvesting in the Fort Nelson TSA there is no incremental silviculture history. However reforestation of all backlog sites in 10 years and conversion of 2 500 hectares of non commercial brush over the next 10 years will be incorporated in the TSR2 analysis.

Herbicide Use - Herbicide availability will affect future yields and delays in establishment that can affect timber quantity and quality. In many stands with Calamagrostis Canadensis aerial application of herbicide is the only option.

Integrated Resource Management - Since TSR1 new administrative constraints brought about by the Forest Practices Code (FPC) and TSA management decisions have impacted timber supply. The following is a list of identified impacts:

Declaration of additional visual quality objectives.

Changes in green-up requirement.

Landscape unit planning.

Wildlife trees (WT) and tree patches (WTP) retention.

Exclusion of the recommended LRMP proposed protected area from the timber harvesting land base.

Eight backlog blocks (314 hectares) are included in the new Klua Lakes protected area. The treatment of these areas will be deferred until a management plan is prepared by BC Parks.

The inclusion of Paper birch-leading stands (SI>17) in the AAC.

Soil Compaction – Summer LoggingIn order to keep the oriented strand board (OSB) plant operating, Slocan is targeting aspen stands for summer harvesting. The Fort Nelson TSA is comprised of stands with fine textured soils – high harvesting disturbance. The following are possible consequences of harvesting on these sites:

Increased soil disturbance (all roads are declared permanent).

Lack of natural regeneration of aspen on compacted sites.

Permanent loss of productive sites (access, roadside-processing areas).

Stocking Standards - Currently, the Fort Nelson TSA is managing to meet minimum stocking standards instead of targets. The TSA is reestablishing riparian areas through increased stocking and various vegetation management options.

2.8.2.2 TIMBER SUPPLY – QUALITY

In the past, areas harvested in the Fort Nelson TSA have been regenerated with lower than optimum planting densities. This could potentially affect future timber quantity.

2.8.3 HABITAT ISSUES

Natural Disturbance Regimes - The issues relating to fire disturbance regimes and forest management practice in the Fort Nelson TSA is similar to that described for the Dawson Creek and Fort Nelson TSA's.

Non Productive Cover Conversion - Areas of non-commercial brush (primarily willow and grass) are being converted to spruce. This often involves heavy reliance on herbicides to control vegetation competition. There may be detrimental effects on the presence and distribution of rare ecosystems.

Wildlife Habitat/Forestry Interaction - Common issues of concern to stakeholders concern the habitat requirements of red-listed species and furbearers, including the maintenance of critical habitat for grizzly bear. There is also uncertainty regarding the potential impacts of silvicultural systems on wildlife habitat

General Issues - The TSA contains vast tracts of relatively undeveloped land that supports abundant diverse and internationally significant wildlife populations. Large nomadic mammals such as moose, black bear, grizzly bear and stone sheep are common. Furbearers such as wolverine, wolf, lynx, weasel, mink, river otter, beaver and coyote are prevalent in the TSA. Regionally significant species include mountain goat, caribou, marten, thinhorn sheep, elk, harlequin duck and northern goshawk..

Most reptiles and amphibians are ill-adapted to the northern climate and few species are present in this timber supply area. However, it is home to a unique range of bird species, many of them eastern species not otherwise found in BC. Conversely, many birds found in other parts of the province do not occur in this timber supply area. The abundant rivers, lakes, ponds and marshes provide important staging grounds during the migration of water birds such as pintails, widgeons, geese and teal.

Many fish species important as game are found in the water bodies of this area. These include some trout species, whitefish, Burbot, Arctic grayling, northern pike and walleye. The rare occurrence of some salmon species has also been noted in some of the major rivers. Approximately 15 game and non-game fish species occur only in this part of the province.

The Boreal White and Black Spruce Zone has the least snowfall of all the northern BC zones and consequently is very important for wintering ungulates. Also in that zone, frequent forest fires have formed a mosaic of upland forests of different ages, providing a variety of habitats. The extensive deciduous forests frequently achieve older age classes and are important for ungulates, birds and small mammals.

2.8.4 SILVICULTURAL PRACTICES

2.8.4.1 SILVICULTURAL HISTORY

Table 2.6.1 records backlog (pre-1988 openings) silviculture for the TSA. Only silvicultural activities which took place after 1985 are shown. Table 2.6.2 records current (post 1998 openings) silviculture achievements.

Table 2.6.1 Backlog silviculture history 1986-99, Fort Nelson TSA

Year	Backlog Site Preparation (ha)	Backlog Planting (ha)	Backlog Brushing (ha)
1986	1659	1175	
1987	2136	1640	235
1988	2066	1659	718.5
1989	1932.7	2686.4	822
1990	1975.5	1514.1	698
1991	2924.8	2214.5	2115
1992	2751	2334	2384
1993	1072.5	1409.3	2441.6
1994	1231.8	823.8	2702.6
1995	628.8	994.2	2050
1996	388.4	907.5	513.3

1997	183.9	131.1	1662.9
1998			1017.8
1999			46.2
Total	**18950.4**	**17488.9**	**17406.9**

Data Source: ISIS Onetime November 23, 1999, IEA Section, Forest Practices Branch

Table 2.6.2 Current silviculture history 1986-99 , Fort Nelson TSA

Year	Backlog Site Preparation (ha)	Backlog Planting (ha)	Backlog Brushing (ha)
1988	368		
1989		346	
1990	76.8	23	171
1991	1377.6	1933.5	
1992	2796.4	2984.4	
1993	3590.9	3415	1600.8
1994	2836.2	3622.7	1271.8
1995	2876.4	3673.2	1526.1
1996	1965.1	4095.6	1702.4
1997	2161.4	5103.8	694.1
1998	1056.9	2956.9	369
1999	45.7	491.7	23.2
Total	**19151.4**	**28645.8**	**7358.4**

Data Source: ISIS Onetime November 23, 1999, IEA Section, Forest Practices Branch

2.8.4.2 BACKLOG SILVICULTURE

The area of backlog not satisfactorily restocked land is 11 000 ha. The area of satisfactorily restocked land is 30 000 ha.

As of October1, 1987 the Ministry of Forests took over responsibility for all areas logged prior to this date. In 1988 the forest Service divided the district into administration zones for backlog purposes. Some zones have almost been completed and have little or no NSR hectares within them.

Slocan forest Products Ltd. is an active participant in the backlog program. The company has prepared a backlog silviculture plan for the adminstration zones assigned to it two years ago and is currently completing on-the-ground activities. Slocan has been assigned three more administration zones last year and they are finishing the planning process and prescriptions for the zones. Majority of the activities for the next year will be in these administration zones.

2.8.4.3 PRECOMMERCIAL THINNING

2.8.4.4 TREE IMPROVEMENT

The projected gain from improved seed for the Fort Nelson Region is tabulated in Table 2.6.3

Table 2.6.3 Project gain from improved seed per species, Fort Nelson TSA

		Gain from Improved Seed (%)

Species & Seed Zone	Elevation (m)	98-99	99-00	2007-08
Sx PR low	<1200	-	-	23
Data Source: Forest Genetics Council				

2.8.5 TSR 1 MANAGEMENT ASSUMPTIONS

In addition to the inventory, or current state of the forest, assumptions about how it will be managed as essential for determining a silviculture strategy.

2.8.5.1 INVENTORY PROFILE

The current inventory of the Fort Nelson TSA is recorded in Table 2.6.4. Mixedwood stands are a component of Table 2.6.5.

Table 2.6.5 Current inventory profile by area, Fort Nelson TSA, 2000

	Current Species Profile of the THLB
Species	Area%
Spruce	43
Aspen	29
Pine	20
Birch	5
Cottonwood	3
Data Source: Fort Nelson Silviculture Strategy Workshop Questionnaire, Jan. 24, 2000	

2.8.5.2 MANAGEMENT ZONES AND FOREST COVER REQUIREMENTS

The TSR1 forest cover requirements used to achieve integrated resource management objectives are listed in Table 2.6.6. Table 2.6.7 illustrates the TSR2 forest cover requirements used in management zones, while Table 2.6.8 lists the forest cover requirements used in draft landscape units.

Table 2.6.6 TSR1 management zones and forest cover requirements for the Aspen Resource Analysis, Fort Nelson TSA, 1992

Analysis unit	Critical minimum green-up age (yrs)	Maximum percent area younger than the critical minimum (green-up %)	Critical minimum mature cover age (yrs)	Maximum percent area younger than the critical minimum (mature cover %)
All analysis units	12	50	80	20
Data Source: Fort Nelson TSA Timber Supply Analysis Report Aspen Resource, 1993, p.32				

Table 2.6.7 TSR2 management zones/groups and forest cover requirements, Fort Nelson TSA, 1997

Management Zone/Group	Green-up height (metres)	Maximum allowable disturbance (% area)
Retention VQO	5	3
Partial retention	5	10
Modification	5	20.5
Maximum modification VQO	5	33
Integrated resource management	3	39
Integrated resource management in major river corridors	3	39
Special management	3	39
Special management in major river corridors	3	39
Data Source: Fort Nelson TSA TSR2 Data Package, 1997, p. 26		

Table 2.6.8 Draft landscape unit forest cover requirements, Fort Nelson TSA 1997

Management Zone/Group	NDT	Biogeo-classification	Minimum age mature and old (years)	Minimum retention area per cent (%)	Minimum age old (yrs)	Minimum retention area per cent (%)
All draft landscape units	2	SwB	n/a	n/a	250	9.4
	3	BWBS-Decid.	80	19.6	100	13.6
	3	BWBS-Conif.	100	18.7	140	11.5
Data Source: Fort Nelson TSA TSR2 Data Package, 1997, p. 27						

2.8.5.3 HARVESTING PRACTICES

Minimum harvestable criteria used in TSR1 are found in Table 2.6.9, while minimum harvestable ages used in TSR2 are found in Table 2.6.10.

Table 2.6.9 Minimum harvestable criteria by leading species, Fort Nelson TSA 1992

		Alternaitve Plan Minimum harvestable volume		Aspen minimum harvestable volume
Type group	**Distance zone**	**A (volume/ha)**	**B (volume/ha)**	**(volume/ha)**
All analysis unit except Aspen	Near	140	100	
	Medium	140	100	
	Far	140	100	
Aspen	Near			150
	Medium			150
	Far			n/a

Data Source: Fort Nelson TSA TSR1 Data Package 1992, p.37

Table 2.6.10 Minimum harvestable criteria by leading species, Fort Nelson TSA 1997

		Minimum criteria		
	Analysis unit	**Height (metres)**	**Volume (m^3/hectare)**	**Minimum harvestable age (yrs)**
1	Spruce	20	140	n/a
2	Spruce/pine	20	140	n/a
3	Spruce/deciduous	20	140	n/a
4	Aspen/coniferous	20	140	n/a
5	Aspen/deciduous	20	140	n/a
6	Pine	20	140	n/a
7	Pine/deciduous	20	140	n/a
8	Cottonwood/coniferous	20	140	n/a
9	Cottonwood/deciduous	20	140	n/a
10	Spruce/larch	20	140	n/a
11	Balsam fir	20	140	n/a

Data Source: Fort Nelson TSA TSR2 Data Package, 1997, p. 19

The 3-year average area harvested is 4 088 hectares. This area is made up of both coniferous and deciduous forest types. The area clearcut was approximately 95% of the total harvest.

The annual volume harvested between 1995 and 1998 is represented in Table 2.6.11.

Table 2.6.11 Annual volume harvested, Fort Nelson TSA

Year	Forest License A17007	Balsam Poplar Forest License A22797	Pulpwood Agreement NO 14
1994/04/01-1995/03/31	**Total** 608,615m3	**Total** 61,355m3	
1995/04/01-1996/03031	**Total** 774,430m3	**Total** 26,027m3	
1996/04/01-1997/03/31	Sw (65%) 569,510m3 Pl (19.4%) 170,354m3 At & Ac (15.6%) **Total** 876,877m3	**Total** 22,173m3	**Total** 373,473m3
1997/04/01-1998/03/31	Sw (64%) 320,418m3 Pl (17%) 83,794m3 At & Ac(19%) 92,906m3 **Total** 497,118m3	No harvestiing	Sw (23%) 82,664m3 Pl (2%) 8853m3 At (75%) 275,616m3 **Total** 367,134m3
1998/04/01-1999/03/31	Sw (84%) 253,628m3 At(13%) 38,491m3 Ac (3%) 10,279m3 **Total** 302,221m3	No harvesting	Sw (15%) 106.295m3 At (82%) 553,614m3 Ac (3%) 17,348m3 **Total** 677,257m3
Data Source: Fort Nelson Silviculture Strategy Workshop Questionnaire, Jan. 24, 2000			

2.8.6 TIMBER SUPPLY DYNAMICS AND AAC - CONIFEROUS AND NON ASPEN GROWING STOCK

The Fort Nelson TSA timber supply analysis (1992) separates the timber supply forecast into coniferous-deciduous and aspen components and so this section is presented in two parts:

- Coniferous and Non-Aspen Timber Supply Dynamics, which deals only with the coniferous harvest forecast and sensitivity analysis;
- Aspen Timber Supply Dynamics, which deals only with the aspen harvest forecast and sensitivity analysis.

The 1992 Fort Nelson Timber Supply Analysis was accomplished before the introduction of the Forest Practices Code. In an attempt to integrate Integrated Resource Management (IRM) guidelines into TSR1 three options were developed:

- Option I - Current Plan
- Option II – Current Performance
- Option III – Alternative Plan (A)

2.8.6.1 TIMBER SUPPLY DYNAMICS – NO CONSTRAINTS OR SILVICULTURE

Option I – Current Plan

For Option I – Current Plan, harvest constraints for accessibility and IRM were assumed to decrease over the next 50 years. The initial amount of net immature timber, which is economically available for harvesting was 18%. This value increased to 30% at the end of 50 years, and 100% for the rest of the planning horizon. The constraints for accessibility (harvest pattern constraints) do not simulate field operations, therefore the effect of these constraints are not considered when viewing the results. The resultant timber supply forecast is not constraint by any factors.

The area of coniferous stands in the timber harvesting land base for TSR1 was 612 763 hectares. The 1992 TSR, upon which the current AAC determination was based, forecasts an initial harvest level of 750 000 m^3 for the first 10 years, declining to a low of 575 000 m^3 at the end of 20 years (Figure 2.6.2). This harvest level then rises to the LRSY of 1 042 000 m^3 in 40 years time.

The area of cottonwood stands in the timber harvesting land base for TSR1 was 53 612 hectares. The 1992 TSR, upon which the current AAC determination was based, forecasts an initial harvest level of 169 000 m^3 for the first 10 years, declining to a low of 123 000 m^3 at the end of 30 years (Figure 2.6.3). This harvest level then rises to the LRSY of 166 000 m^3 in 50 years time.

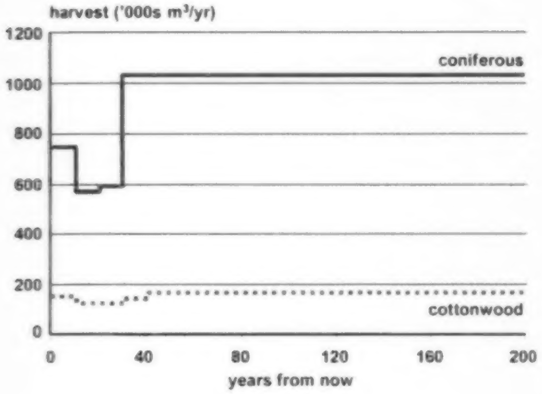

Figure 2.6.2 **Coniferous and cottonwood base case harvest forecast, Fort Nelson TSA 1992**

The harvest forecast for coniferous stands can increase by 45% after decade 4 because of the amount of immature sites becoming operable. The initial percentage of merchantable immature stands was 18%, but when the forecast reaches the 4th decade 100% of these stands become operable contributing to the timber supply forecast.

The cottonwood harvest forecast can also be explained by the amount of immature stands coming on-line. Once immature stands become operable harvest levels can be increased.

2.8.6.2 SENSITIVITY TO LAND BASE REDUCTIONS AND FOREST COVER CONSTRAINTS

Option II – Current Performance

Option II – Current Performance sets constraints to account for harvest pattern by utilizing a two pass harvesting system (50%/50%) with a 10 (cottonwood) and 20 (coniferous) year harvesting delay between passes. It was assumed this scenario would account for buffer strips, site degradation, and roads and rights of way. Also constrained is the amount of area in the timber harvesting land base. For the coniferous scenario the THLB was reduced by 42%, while the cottonwood scenario THLB was reduced by 86%. Both of these reductions drastically lowered the amount of available timber and subsequent harvest levels.

In this early attempt to model constraints such as buffers, site degradation and roads as well as possible land base reductions it was shown that these constraints will decrease harvest levels as shown by the differences in the harvest forecasts for Option I and Option II for both coniferous (Figure 2.6.4) and cottonwood(Figure 2.6.5) harvest forecasts.

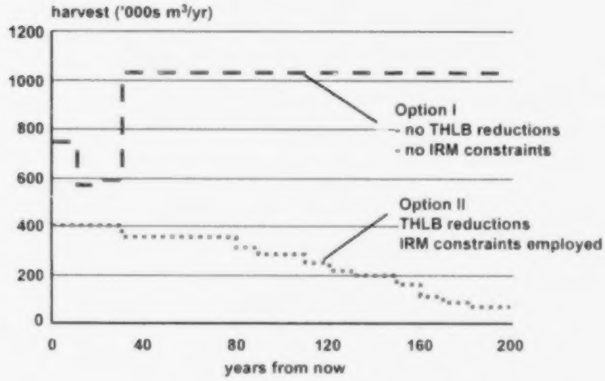

Figure 2.6.3 **Sensitivity of coniferous harvest forecast to THLB reductions and constraints, Fort Nelson TSA 1992**

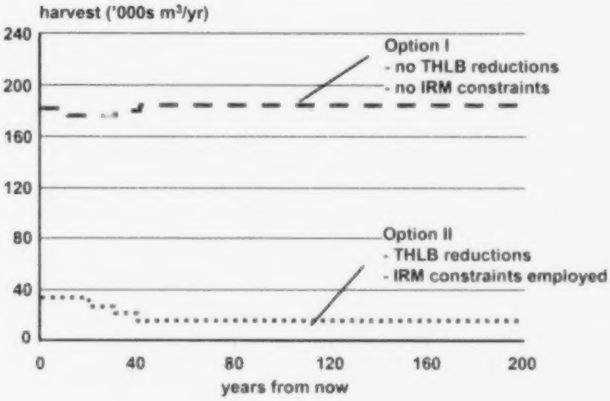

Figure 2.6.4 **Sensitivity of coniferous harvest forecast to THLB reductions and constraints, Fort Nelson TSA 1992**

Various silvicultural activities and shifts in forest product objectives can be interpreted as bringing land into the timber harvesting land base and so the comparison of Option I and Option II (Figure 2.6.3 and Figure 2.6.4) will provide information on the magnitude and timing of the benefits. Decreases to the timber harvesting land base will decreases timber supply across the entire planning horizon.

2.8.6.3 SENSITIVITY TO SILVICULTURAL ACTIVITIES AND INTEGRATED RESOURCE MANAGEMENT

Option II – Current Performance

Figure 2.6.5 illustrates three scenarios examining alternative silviculture scenarios on the coniferous component of the THLB. The first scenario which employs current silviculture (1992) has a lower harvest rate compared to the second scenario which utilizes basic silviculture. Basic silviculture, in this case, increases the amount of merchantable stands found in the timber harvesting land.

The last scenario, incremental silviculture defined as a planned level of NSR and NCBr reforestation will have a higher harvest level than the basic silviculture scenario because the future inventory is increased by 1 800 hectares per year.

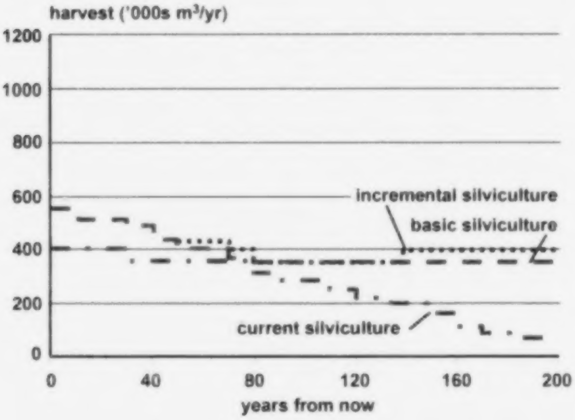

Figure 2.6.5 **Silvicultural impacts on the coniferous harvest forecast, Fort Nelson TSA 1992**

Option III – Alternative Plan (A)

In this scenario, the simulation of timber harvesting activities integrated with other resource values was accomplished. Table 2.6.12 lists the resource units and management priorities.

Table 2.6.12 **Resource units and associated management priorities, Fort Nelson TSA 1992.**

Resource Unit	Management Priority
RU 1	An area with future timber potential, but not economic at this time. This area has other resource values which at the time are conserved through the exclusion of these areas from the AAC.
RU 2	An area that has world class wilderness and outdoor recreation opportunities. This area will be conserved through limited timber harvesting with harvesting constraints to achieve wildlife habitat objectives.
RU 3	An area that, in addition to some moderate tomber values, has important visual, outdoor recreation, and wildlife habitat. This area will be conserved through limited timber harvesting with harvesting constraints to achieve visual, outdoor and wildlife habitat objectives.
RU 4	An area that has important timber values as well as important wildlife objectives. This area will also be managed as an integrated resource area but with less severe harvesting constraints.
RU 5	An area with less important timber values but important subsurface values. No timber harvesting constraints are applicable in this area.

RU 6	An area that has existing and potential agriculture development. This land base no longer supports the AAC.
Data Source: Fort Nelson TSA Analysis Report 1992, p. 7	

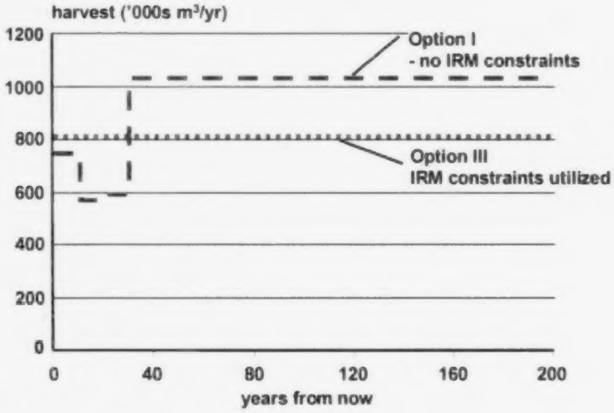

Figure 2.6.6 **Sensitivity to integrated resource management on the coniferous harvest component, Fort Nelson TSA 1992**

The forest inventory was disaggregated into the resource units in order to have the applicable constraints imposed. A three pass harvesting system was modeled in the RUs 2 and 3, and a two pass system in RU 4.

Figure 2.6.6 illustrates the effects of integrated resource management on the harvest forecast. The harvest forecast which does not take into account other values (Option I), is substantially higher than Option III.

Changing environmental and social values affects the harvest forecast because of constraints placed on the amount of stands older than a specified age (Figure 2-4). When old-growth forest cover requirements become increasingly restrictive the amount of area which can be of a mature age is lessened causing the harvest forecast to be lower than Option I which employs no IRM constraints. This decrease can be attributed to further restrictions placed on the mature surplus of timber. Constraints set in the analysis will be increasingly met when the mature cover constraints are increased.

It should also be noted that employing alternative silvicultural treatments aids in alleviating certain forest cover constraints. Several harvesting techniques and equipment could be used to retain merchantable older timber in a certain area, therefore lessening the number of green-up and old-growth forest cover constraints being met. This allows the harvest forecast to capture additional volume from the surplus available.

Figure 2.6.7 demonstrates the effects of silvicultural activities on the harvest forecast. Increasing regeneration capabilities of regenerating and non-merchantable stands leads to increased harvest forecasts. Bringing non-merhcantable land into the THLB through incremental silviculture, will have immediate and long-term effects on the timber supply forecast. It should also be noted that coniferous volumes are higher than mixedwood volumes, therefore if the land base regenerates to coniferous stands the growing stock will increase leading to increased harvest forecasts.

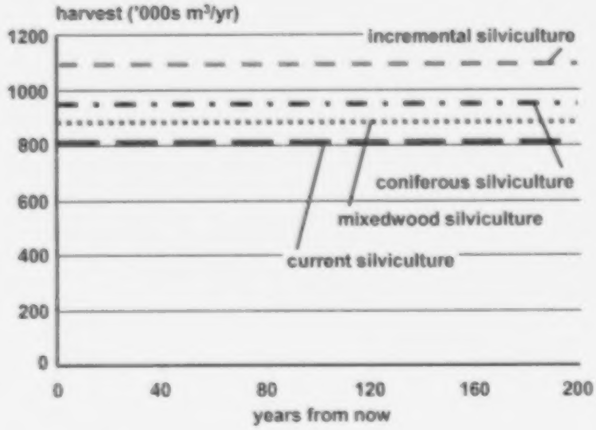

Figure 2.6.7 **Sensitivity of the coniferous harvest component to silviucltural activities, Fort Nelson TSA, 1992**

Silvicultural regimes can be employed to reduce the number of years to reach free-growing status (regeneration delay). Pre-free growing regimes such as improved planting stock, site preparation, herbicide and fertilization are just a few examples of regimes which could lessen the number of years required to reach free-growing status.

2.8.6.4 SENSITIVITY TO UTILIZATION STANDARDS

Option III – Alternative Plan (A) – Alternative Utilization Strategies

Two scenarios were employed to demonstrate the effects of alternate utilization standards:

- current utilization standards of deciduous species and basic silviculture of all harvested areas emphasizing mixtures of coniferous and deciduous species in mixedwood stands;
- close utilization standards of deciduous species and basic silviculture of all harvested areas emphasizing mixtures of coniferous and deciduous species in mixedwood stands.

Figure 2.6.8 to 2.6.10 illustrate the effects of alternate utilization standards on coniferous, cottonwood, and apsen components of the THLB.

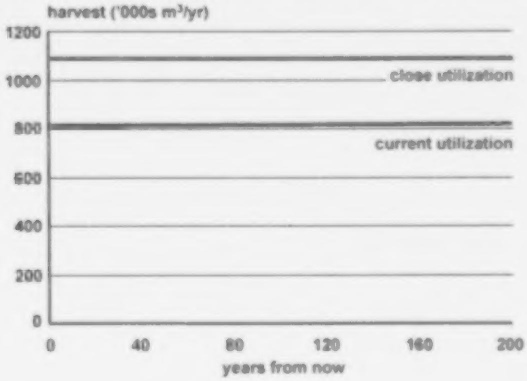

Figure 2.6.8 Sensitivity to alternate utilization standards on the coniferous harvest forecast, Fort Nelsen TSA, 1992

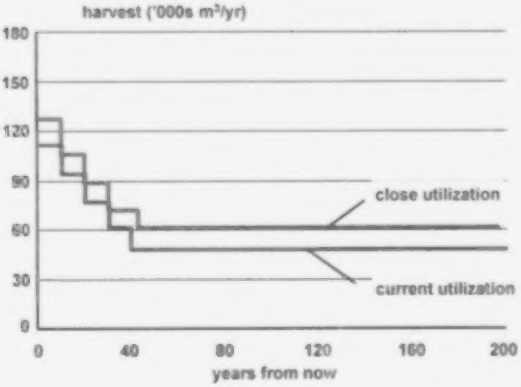

Figure 2.6.9 Sensitivity to alternate utilization standards on the cottonwood harvest forecast, Fort Nelsen TSA, 1992

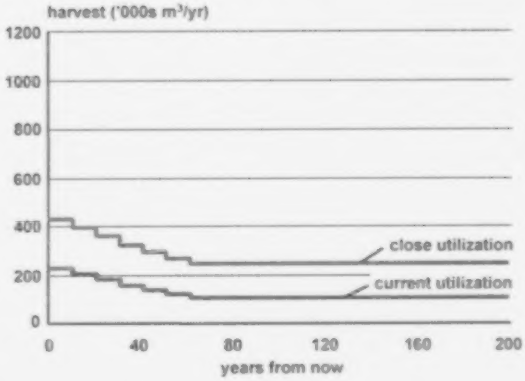

Figure 2.6.10 Sensitivity to alternate utilization standards on the aspen harvest forecast, Fort Nelsen TSA, 1992

In all three scenarios the harvest forecast can be increased by utilizing additional portions of the THLB. Several harvesting techniques and equipment could be used to retain merchantable species in stands. This allows the harvest forecast to capture additional volume from the surplus available.

2.8.7 TIMBER SUPPLY DYNAMICS AND AAC - ASPEN GROWING STOCK

The aspen review was limited to Forest Licence A32900. The THLB supporting the analysis was 472 716 hectares . A priority of the analysis was incorporating the IRM objectives listed in Table 2.6.6.

An even-flow harvest level of 1 108 500 m³ per year is forecasted (Figure 2.6.11). The level can maintained due to the current age class distribution and growth rate of the deciduous species. Over 70% of the area is mature. Once aspen leading stands are harvested they are assumed to regenerate back to aspen. Aspen stands will have a high growth rate due to the competitive nature of the species (non-shade species). These stands will have accelerated life cycles, therefore constantly replenishing the growing stock and supporting the harvest forecast.

It should be noted that the IRM objective that no more than 50% of the THLB be in a non greened-up state (less than 12 years old) at any time could be pushed to no more than 11% of the THLB in a non greened-up state before the LTHL would be adversely affected.

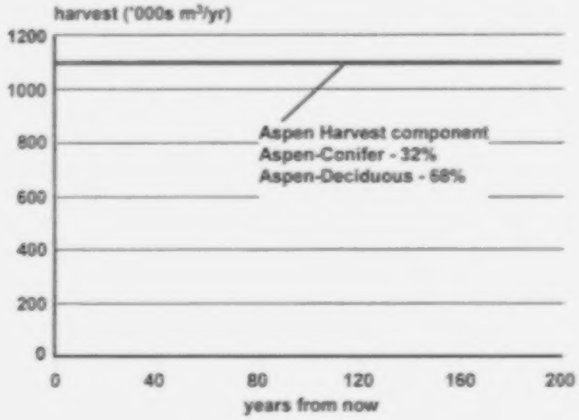

Figure 2.6.11 **Aspen harvest forecast, Fort Nelson TSA, 1992**

2.8.8 TIMBER SUPPLY DYNAMICS - SUMMARY

The only constraint on timber supply in the Fort Nelson TSA is the physical scarcity of harvestable timber in the early short to early mid-term. This scarcity requires that volumes of existing mature timber from unmanaged stands be rationed until immature stands are ready for harvest. The rationing mechanism (TSR harvest flow constraints) can also be used to convey back to the short- and early mid-term the future timber supply benefits resulting from manipulating forest-level parameters. Silvicultural practices that modify stand yields, and the extent of the timber harvesting land base will have significant effects on timber supply.

Utilizing alternative silvicultural methods can lessen the amount in which the timber supply is reduced. Numerous harvesting techniques and equipment could be utilized to alleviate the constraints set by integrated resource management and utilization standards, therefore allowing harvesting to occur in stands which were previously tied up in forest cover requirements or lost entirely due to differing utilization standards.

2.8.9 THE TIMBER SUPPLY (TSR2) CONTEXT OF SILVICULTURE

The Fort Nelson TSA is undergoing TSR 2 analysis at the time of this RMP. The potential implications to sustainable harvest silviculture planning of the new TSR assumptions is included here for reference. The full impact of the new analysis will be reflected in the 2002 Sustainable Harvest RMP.

2.8.9.1 TIMBER SUPPLY FORECAST AND THE AAC

Figure 2.6.12 shows the base case forecast for deciduous stands remaining at the current AAC of 900 000 m^3 for 200 years. However, the TSR2 representation of the timber harvesting land base is forecast to sustain a conifer harvest of 1 396 000 m^3. This base case level is more than twice the current conifer AAC.

The timber supply (both conifer and deciduous) is most sensitive to the site index thresholds used to exclude stands of low productivity from the timber harvesting land base. These thresholds were developed from a review of recent harvesting operations but they respond to shifts in costs and market prices, so are inherently uncertain. As illustrated on Figure A5-1, conifer supply fluctuates from 19% below the base case to 32% above, depending on whether or not the upper or lower end of the range of uncertainty is used to set the threshold. Similarly, the deciduous resource could increase to 21% above the base case if the lower end of the site index threshold were used, and would be 35% lower (long-term timber supply) if the upper end were used.

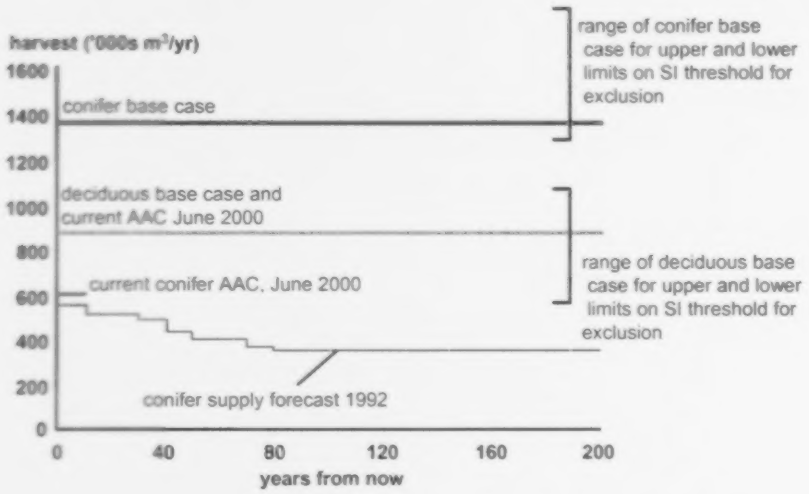

Figure 2.6.12 Base case harvest forecasts for conifer and deciduous stands.

2.8.9.2 BLACK SPRUCE – A CRITICAL ISSUE

The potential to include black spruce in the timber harvesting land base was identified in the report as critical issue with respect to timber. Black spruce was excluded due to uncertainties about the inventory as well as limited harvesting performance. However, the potential impact on conifer timber supply of including black spruce (above a site index threshold specified in the report) is substantial – 30% over the next 100 years, relative to the base case harvest projection. A reduction in inventory related uncertainties may make black spruce an attractive resource.

A further obstacle to the harvesting of black spruce stands are silvicultural and regeneration difficulties associated with a high water table. The report notes that as more specific ecological (site series) inventories are completed, it may be possible to make specific land base exclusions where regeneration problems are anticipated.

2.8.9.3 MIXED WOOD MANAGEMENT -- A CRITICAL ISSUE

The management of mixedwood stands is also identified in the report as a critical issue. Mixedwood coniferous leading stands comprise 35% of the coniferous timber harvesting land base and excluding them reduces timber supply by 27.5%. Mixedwood deciduous leading stands comprise 32% of the decidous timber harvesting land base and excluding them reduces timber supply by 33% over the long term. The report notes that Ministry of Forests staff are currently working with the local forest industry to develop a mixedwood management strategy.

2.8.9.4 CONCLUSION

The TSR2 Fort Nelson Timber Supply Area Analysis Report identifies three issues that may help guide silviculture planning on the management unit:

- Both the conifer and deciduous timber supply are very sensitive to the site index thresholds used to exclude stands of low productivity from the timber harvesting land base. These thresholds represent economic margins and respond to changes in operating costs and market prices.
- Silvicultural and regeneration difficulties associated with a high water table are an obstacle to the to the inclusion of black spruce stands in the conifer timber supply.
- Silviculture management of mixedwood stands is not fully understood and current practices may result in silviculture costs that are higher than is necessary and degradation of habitat.

2.8.10 KEY ISSUES AND POTENTIAL SILVICULTURAL STRATEGIES

This section identifies the key Sustainable Harvest issues facing the TSA, as well as potential silvicultural strategies suitable for addressing them. Of those resource supply issues described in Section 2.6.2, four are considered key by management unit stakeholders:

- Spruce budworm infestation losses.
- Potential productivity losses within the timber harvesting landbase.
- Productivity losses due to non commercial forest cover.
- Potential losses of timber production due to management constraints within riparian zones.

Strategies considered feasible and desireable are listed in Table 2.6.13, along with their priority rankings determined by management unit stakeholders. The forest level impacts of each stategy and tactic are estimated in Table 2.6.14. This set of strategies must be considered provisional at this time; they must be analysed and evaluated in further forest estate modelling.

Most importantly, the resource inventory on which they are based must be updated to ensure the current state of the forest is accurately described. If this is not done, apparent issues and possible strategic solutions could be misleading. In the meantime, and for this RMP, local technical expertise, current policies and present uncertainties surrounding some of the strategies

Table 2.6.13 Key issues and possible silvicultural strategies and tactics for the Fort Nelson TSA.

Key Issues	Management Objective	Silvicultural Strategy	Target Stands	Silvicultural Tactics	Priority
1. Budworm Infestation Losses	Suppression of budworm	1.1 Infestation Control	Infested plantations	BT spray	2
2. Productivity of THLB TSR assumes backlog reforested in 10 years but assumes herbicide use, does not recognize 1st nations issues, uncertainty w/r funding and underfunding, uncertainty as to priority	Maintain production on THLB	2.1 Maintain the Timber Harvesting Land Base	Backlog NSR	Surveys - all stages	1
				Site preparation	1
				Planting	1
				Brushing	1
		2.2 increase Operability	Impeded stands	Brushing - chemical	1
				Brushing – manual	1
3. Productivity Losses of NCBr. TSR assumes backlog reforested in 10 years; habitat issue is that willow and grass --> spruce, reduces diversity, question economics; loss of mature willow (habitat opportunities); conflict re herbicide	Afforest NCBr	3.1 Increase the Timber Harvesting Landbase	NCBr	Surveys – all stages Site preparation Planting Brushing - manual Brushing - chemical	3
4. Productivity Losses in Riparian Management Zones Harvesting to streamside; backlog; herbicides restricted	Develop Management Methods for Riparian Znes	4.1 Increase Operability/Increase Yields	Backlog in riparian zones	Surveys	4
			Backlog in riparian zones	Brushing - manual	4

Table 2.6.14 Key Issues, silvicultural strategies and tactics with forest level impacts, Fort Nelson TSA

Key Issues	Silvicultural Stategies	Silvicultural Tactics	Opportunity	Timber Supply Effects				Habitat	Jobs	Cost	
			Area	Short	Medium	Long	Quality		Days/ha	$/ha[1]	Rank
				0-20	21-120	121+					
Budworm Infestation Losses	1.1 Control Infestation	BT Spray Program	560		M	M		+/-	0.1	400	2
Potential Loss of THLB	2.1 Maintain THLB	Surveys – backlog (all stages)	6000			M		+/-	0.1	60	1
	2	Site Prep./plant/brush - NSR	600			M		+/-	2.5	1600	
	2	Chemical Brushing - impeded	900			M		+/-	0.2	400	1
	2	Manual Brushing - impeded	670			M		+/-	4.0	1400	
											3
Potential Productivity Losses on NCBr	3.1 Increase THLB	Surveys	1000			M		+/-	0.1	60	
	3	Site Preparation	250			M			0.6	400	
	3	Plant	250			M			2.0	800	
	3	Chemical Brushing	250			M			0.2	400	
	3	Manual Brushing	250			M			4.0	1400	
											4
Potential Productivity Losses due to Ribparian Constraints	4.1 Maintain THLB/Increase Yields	Manual Brushing	10					+	4.0	1400	
	4	None (stratify for habitat management)						+			

2.8.10.1 ISSUE 1: BUDWORM INFESTATION LOSSES

Strategy 1.1: Control Budworm Infestation

TACTIC 1 – UNDERTAKE A BT SPRAY PROGRAM IN THE TSA

Target Stands:

Infested and threatened stands in the TSA.

Expected Forest Level Benefits:

Strategies to protect forest health are intended to maintain conditions favorable for maximizing timber production. Avoiding pest problems will help maintain productivity levels already assumed in TSR, thus no gains per se are expected. A widespread population control program is not anticipated, but localized protection of threatened plantations using spray programs may be of value.

2.8.10.2 ISSUE 2: POTENTIAL LOSS OF PRODUCTIVITY IN THE THLB

Strategy 2.1: Maintain the Size and Productivity of the Timber Harvesting Land Base

TACTIC 1 – BACKLOG NSR TREATMENT REGIMES

and

TACTIC 2 – BACKLOG IMPEDED STAND TREATMENT REGIMES

Target Stands:

All backlog NSR and impeded stands in the TSA.

Expected Forest Level Benefits:

The Fort Nelson TSA has a larger than average proportion of backlog stands requiring treatment to reach free growing. TSR II assumed that all backlog areas would be treated over a period of 10 years. Current funding levels, however, are sufficient to treat this area at only approximately half the assumed rate, requiring a 20-year period for completion. This in turn will result in a delay in areas again being available for harvest 10-14 decades from now, around the time of the transition from primarily old growth harvesting to primarily second growth harvesting. Delayed availability of some second growth stands may result in a small fibre supply deficit at that time. This is particularly critical given that backlog sites tend to be some of the most productive in the TSA.

2.8.10.3 ISSUE 3: PRODUCTIVITY LOSSES DUE TO NON-COMMERCIAL FOREST COVER

Strategy 3.1: Increase the Size of the Timber Harvesting Landbase

TACTIC 1 – NON-COMMERCIAL BRUSH REHABILITATION TREATMENT REGIMES

Target Stands:

Stands regenerated to non-commercial forest cover following wildfire throughout the TSA.

Expected Forest Level Benefits:

It is estimated that the Fort Nelson TSA includes 500,00 to 800,000 of land that has regenerated to non-commercial species, primarily brush, after wildfires. Conversion of non-commercial timber types to commercially valuable forest cover would increase the size of the timber harvesting land base.

In the timber supply analysis for TSR II it was assumed that 2500 ha would be converted over the next 10 years. Assuming average productivity for the TSA, this is sufficient to increase the LTHL by 6900 m^3/yr. Each additional 2500 ha treated would have a similar effect. Currently, achievement of this assumed treatment is questionable, as funding is insufficient to treat all backlog sites which are considered high priority by the District.

Conversion treatments consist of clearing existing cover, planting, and controlling brush. The cost of these treatments ranges from $1600/ha to $2600 /ha.

2.8.10.4 ISSUE: POTENTIAL PRODUCTIVITY LOSSES DUE TO MANAGEMENT CONSTRAINTS IN RIPARIAN ZONES

Strategy 4.1: Maintain the Size of the Timber Harvesting Land Base/Increase Yields

TACTIC 1 – SURVEY AND RECLASSIFY POTENTIAL FOR HABITAT VS TIMBER

and

TACTIC 2 – IMPEDED STAND BRUSHING – MANUAL

Target Stands:

Riparian management zones in the NSR land base.

Expected Forest Level Benefits:

A small portion of the backlog NSR area consists of riparian areas. A strategy is required to deal with these areas, probably including altered stocking standards, in order to protect or enhance their value as habitat. It was estimated that only a very small area (10 ha) would be treated each year.

2.8.11 RECOMMENDED KNOWLEDGE STRATEGIES

There are many related TSA silvicultural issues which are not directly addressable via silvicultural practices. Many of these require investigation and further study. Table 2.6.15 identifies, and ranks the importance of 8 Sustainable Harvest knowledge gap issues.

Table 2.6.15 Issues requiring further investigation.

Issue	Rank
Herbicide use Concern was expressed in the workshop regarding future availability of herbicides as a silvicultural tool. This concern is rooted in local perceptions of habitat loss from reduced natural variability, and herbicide use being a negotiation item in discussions with the local First Nation. Inability to use herbicides may result in reduced stocking and thus lower yields, and/or reductions to the timber harvesting land base. *There is a need to estimate potential stand level impacts of a "no herbicide" policy, and to use FSSIM to investigate impacts on timber supply.*	1
Mixedwood management Silviculture management of mixedwood stands is not fully understood; practices to maintain current mixtures in future stands are poorly defined if defined at all – existing stocking standards for mixedwoods are based on largely on theory and speculation. Current practice by intent is to "unmix" the mixedwoods, trending toward either pure deciduous or pure conifer stands. Recognized drawbacks to this strategy include potentially higher than necessary silviculture costs and potential degradation of habitat where certain niches depend on conifer-deciduous mixtures. *Further support and expansion is required for basic stand level studies into mixedwood management, including both licensee and MoF initiatives, with cooperation across the boreal region of the four western provinces.*	2
Budworm Levels of budworm losses have become increasingly heavy in the Fort Nelson TSA over the last decade, and particularly in the last year. In unmanaged older stands, increased mortality related to this pest has introduced doubts about the "shelf-life" of old growth volumes in relation to that assumed in TSR. In young managed stands, there is ongoing risk stocking losses, particularly where young stands are immediately adjacent to infested older stands. Understory layers in stands are at particular risk, thus threatening the understory conifer layer in some mixedwoods, resulting in reduced options for future management. *There is a need to investigate management options for budworm and their impacts on both timber supply and options for silviculture systems.* Such a study should consider both active treatment options and strategies for stand management with budworm populations as part of the overall forest management context (i.e. the budworm is there – how do we best live with it?). It should be cognizant of potential impacts of different strategies on insect population dynamics, timber supply, habitat and other resource values.	3
Aspen suckering on compacted sites Concern was expressed that a recent shift toward increased summer logging of aspen sites may be resulting in increased amounts of permanent access structures. This concern arises from sites where compaction on skid roads and/or roadside processing areas inhibits suckering of aspen, leaving these areas poorly- or non-stocked. It is assumed that with winter harvesting, compaction would be avoided on most of these areas. *A study is required to quantify the impact of summer harvesting on post-harvest stocking conditions.* This information could then be used to make informed decisions about the costs and benefits of this strategy, and to make appropriate area net-downs related to stocked area for TSR.	4

Salvage Concern was expressed that large amounts of unsalvaged losses occur related to budworm and bark beetle activity. It is perceived that many older stands are losing volume over time, and that TSR yield curves are insensitive to this effect. One study on this problem is nearing completion. *A strategy is required to identify high risk stands so that they can be moved up in the harvest queue*. Current losses to insects are estimated at 34,000 m^3/yr.	5
Low stocking SR Concern was expressed that backlog and older appraisal blocks (approx. pre-1995) may have lower stocking levels than assumed in TSR Blocks with ≥80% conifers only). This could potentially lead to an assumption in the TSR timber supply analysis that yields for these stands are higher than will actually be achieved. *A study is required to assess actual stocking levels on older cut blocks compared to TSR assumptions.* This in turn could lead to an analysis of impacts on timber supply projections.	6
LRMP Protected Area Exclusions Responsibility for silviculture activities on 8 blocks within the newly created Klua Lakes park needs to be resolved. This process is underway.	7
Black Spruce Silvicultural and regeneration difficulties associated with a high water table are an obstacle to the to the inclusion of black spruce stands in the conifer timber supply. Ecological (site series) inventories should be undertaken in order to enable specific land base exclusions where regeneration problems are anticipated.	8

2.8.12 MANAGEMENT UNIT SUSTAINABLE HARVEST PLAN – 2002-2007

2.8.12.1 ENHANCED FORESTRY PROGRAM

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Stand Tending	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	0	0	0	0	0.00	0	
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	0	0	0	0	0	0.00	0	
Other	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Planning and prescriptions							0	
Total dollars							0	

Forest Health Enhancement

	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Other treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Habitat Supply and Biodiversity Enhancement

	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Riparian treatments	0	0	0	0	0	0.00	0	
Non-riparian treatments	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	

Domestic Range

	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Treatments	0	0	0	0	0	0.00	0	

Enhanced Forestry Activities - Management Unit Total

	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	0	0	0	0	0	0.00	0	
Spacing	0	0	0	0	0	0.00	0	
Pruning	0	0	0	0	0	0.00	0	
Fertilizing	0	0	0	0	0	0.00	0	
Other stand tending activities	0	0	0	0	0	0.00	0	
Totals hectares	0	0	0	0	0	0.00	0	
Planning and prescriptions							0	
Studies funding							0	
Total dollars							0	

2.8.12.2 BACKLOG FORESTRY PROGRAM

Activities	Treatment Area Goals (ha)					Plan 2002/03		
Legal Obligations	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)	Priority
Surveys	550	550	550	720	350	40.00	22000	H
Site preparation	100	0	0	0	0	580.00	58000	M
Planting	200	100	0	0	0	1,000.00	200000	H
Brushing	450	300	200	150	200	650.00	292500	H
Max. density spacing	0	0	0	0	0	0.00	0	
Totals hectares	1300	950	750	870	550	440.38	572,500	
Seed purchase	200	100	0	0	0	800.00	160000	H
Total legal obligations							732,500	
Backlog Reforestation								
Surveys	340	340	340	340	340	40.00	13600	H
Site preparation	150	100	100	100	100	580.00	87000	H
Planting	250	200	200	200	200	500.00	125000	H
Brushing	200	200	250	200	200	580.00	116000	H
Totals hectares	940	840	890	840	840	363.40	341,600	
Seed purchase	250	200	200	200	200	400.00	100,000	H
Prescriptions and planning dollars							7,500	H
Total backlog reforestation							449,100	
Impeded areas								
Surveys	2500	2500	2500	2500	2500	40.00	100000	H
Brushing	1900	1900	1900	1900	1900	650.00	1235000	H
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	4400	4400	4400	4400	4400	303.41	1,335,000	
Prescriptions and planning dollars							31,700	H
Total impeded areas							1,366,700	
Site Restoration								
Fill planting	0	0	0	0	0	0.00	0	
Rehabilitation	250	250	250	250	250	700.00	175000	M
Reforestation	250	250	250	250	250	1,000.00	250000	M
Totals hectares	500	500	500	500	500	850.00	425,000	
Seed purchase	250	250	250	250	250	800.00	200,000	M
Prescriptions and planning dollars							8,500	M
Total site restoration							633,500	
Backlog Program Activities - Management Unit Total								
Surveys	3390	3390	3390	3560	3190	40.00	135600	
Site preparation	500	350	350	350	350	640.00	320000	
Planting	700	550	450	450	450	821.43	575000	
Brushing	2550	2400	2350	2250	2300	644.51	1643500	
Density spacing	0	0	0	0	0	0.00	0	
Totals hectares	7140	6690	6540	6610	6290	374.52	2674100	
Seed purchase	700	550	450	450	450	657.14	460000	
Prescriptions and planning							47,700	
Recommended studies							0	

2.8.12.3 MANAGEMENT UNIT FRBC PERFORMANCE

	Performance Measure	Tree Improvement	Nursery Seedling Production	Silv. Survey	Site prep.	Backlog Plant	Brush	Space	Prune	Fertilize	Support staff and admin	Totals
	Inputs											
A	**Planned treatment area (ha) in 2002/2003**	700	0	1,119	500	700	2,550	0	0	0	5,569	
1.0	**Timber Supply**											
1.1	Potential volume/ha gain (m3/ha/yr)	0.41	0	0	0	2.9	0.41	0.25	0	0.40		
1.2	Years the factor will apply	65	65	65	65	65	65	65	65	65		
1.3	Pot. total merch. volume increment in 65 years (m3)	18,655	0	0	0	133 770	67,958	0	0	0		**220,383**
1.4	Est. yrs reduced to achieve management objectives	5-10	1-3	5-10	0	5-20	5	5-30	0	5-10		
1.4	Est. area that will be reclassified as stocked (ha)			0								**0**
1.5	Est. area that will be declared as free growing (ha)			0								**0**
2.0	**Wood Value**											
2.1	Percent improvement in total value at harvest (Compared to no treatment)							5-15%	15-30%	1-5%		
3.0	**Employment**											
3.1	Estimated short term employment (person days/ha)	0.1	0.34	0.1	0.95	2	2.61	3.96	4.54	0.18	0.1	
3.2	Estimated total employment (person days/year)	70	0	112	475	1,400	6,656	0	0	0	557	
3.3	Estimated total full time equivalent positions (FTE)	0	0	1	3	8	37	0	0	0	3	**51**
4.1	**Forest Health Enhancement (ha)**											**0**
5.1	**Habitat Supply**											
5.2	Planned area for specific wildlife forage or habitat maintenance in 2002/2003 (ha)											**0**
5.3	Est. area with secondary value provided to biodiversity (ha)											**0**

2.8.12.4 MANAGEMENT UNIT SUMMARY TABLE

	Treatment Area Goals (ha)					Plan 2002/03	
	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	Unit Cost ($/ha)	Funding ($)
Enhanced Forestry Program Field Activities	0	0	0	0	0	0	0
Planning, prescriptions and seedlings							0
Backlog Program Field Activities	7,140	0	0	0	0	375	2,674,100
Planning, prescriptions and seedlings							507,700
Totals	7,140	0	0	0	0		3,181,800

Performance Measures

Potential total merchentable volume increment in 65 years	220,383 m^3
Estimated ha that will be reclassified as stocked	0 ha
Estimated ha that will be declared as free growing	0 ha
Estimated total full time equivalent positions generated	51 FTEs
Forest health enhancement area	0 ha
Planned area for specific wildlife forage or habitat maintenance	0 ha
Estimated area with secondary value provided to biodiversity	0 ha

2.9 SUMMARY OF MANAGEMENT UNIT PRIORITIES

2.9.1 PRINCE GEORGE TSA

Key Issues	Silvicultural Strategy	Silvicultural Tactics	Priority
Mid-term gap in fibre supply	Move Stands up in Harvest Queue (increase operability)	Thinning Fertilization	11
		PCT preparatory to CT	5
	Increase Volume Yields	Fertilize on 10-yr cycle	10
		Fertilize on 10-yr cycle	10
		Survey IU Stands	3
		Reclassify/Harvest IU Stands	4
Productivity of Backlog stands	Maintain Productivity ofTHLB Land Base	Survey and reclassify	1
		Site preparation Planting brushing	2
		Brush/space	1
		Brush/space	2
		Brush, space	2
		site prep, plant under canopy or in voids	8
		Site prep plant IU	8
Managed Stand Pest Losses	Minimize Stocking Losses due to Infections	Prune infected branches	7
		Monitor/Map risk due to forest health hazards	6
Repression Losses	Increase THLB/increase yields by treating repressed Pli stands to make them operable/replacing them with normal stands	Survey	5
		Reclassify, bring into THLB, early harvest	5
		Rehabilitate and plant	5
		Thin, fertilize	5
Maintaining Timber Quality	Clearwood pruning	Branch pruning, single lift	12

2.9.2 ROBSON VALLEY TSA

Key Issues	Silvicultural Strategy	Silvicultural Tactics	Priority
Declining short, medium and long term timber supply	Reduce minimum harvestable ages by 10 years	precommercial thinning (juvenile spacing)	5
		precommercial thinning	6
	Increase the volume of regenerated stands by 20%	repeat fertilization, 15year cycle	nr
		repeat fertilization, 15year cycle	7
	Maintain the timber harvesting land base	survey	1
		brush	2
		site prep	3
		plant	3
Pest losses to juvenile white pine	Prune to reduce risk of infection	Infected branch pruning	4
Declining timber quality	Clearwood prujning	Branch pruning	8

2.9.3 MACKENZIE TSA

Please consult the Mackenzie Sustainable Resource Management Plan (MSRMP)(Appendix 2) for a comprehensive analsysis of management unit priorities.

2.9.4 DAWSON CREEK TSA

Key Issues	Silvicultural Strategies	Silvicultural Tactics	Priority
Uncertainty in critical issues	Improve Knowledge (SI estimates on backlog)	add growth intercept to FG surveys of treated backlog	1
		add growth intercept to FG surveys (re FG)	1
	Improve Knowledge (Deciduous Stocking)	expand survey to include deciduous—update ledger	1
	Improve Knowledge (Monitoring for vegetation management)	install NIVMA plots	1
Loss of Productivity on Backlog Sites	Maintain Timber Harvesting Land Base (Retire all NSR)	survey to determine opportunities	1
		conifer treatment regimes	1
		deciduous treatment regimes	1
		mixedwood treatment regimes	1
	Maintain Timber Harvesting Land Base (Convert NCbr to THLB	Cut and pile mound, plant, herbicide, survey, fill-plant	3
	Maintain Timber Harvesting Land Base (Convert NCbr to grazing land)	survey and grazing plan	2
		MSP and seeding	3
Decline in Deciduous Harves	Increase Yields (Protect regenerating aspen stands from grazing)	grazing plan to move cattle out of susceptible young stands	2
		implement grazing plan	3
Security of Conifer Harvest	Improve Operability (Reach FG earlier)	survey (pre-early FG)	3
	Maintain Productivity of Timber Harvesting Land Base (Mitigate impact of calamagrostis)	develop methodology for assessing risk pre-harvest	1

2.9.5 FORT ST. JOHN TSA

Key Issues	Silvicultural Strategies	Silvicultural Tactics	Priority
Maintain or Enhance the THLB	NSR Reclassification	photo interpretation	1
		ground surveys	1
	NSR Reforestation	site preparation	1
		planting	1
		manual brushing	1
		herbicide brushing	1
		surveying	1
	Surveys	low productivity sites	2
		non-merchantable stand types	2
		NC Br (recce survey)	3
		old oil and gas roads and well sites	4
Mitigate Fall-down of Deciduous Harvest	Aspen management	fill-plant, or herbicide/plant improved aspen genotypes	5

2.9.6 FORT NELSON TSA

Key Issues	Silvicultural Strategy	Silvicultural Tactics	Priority
Budworm Infestation Losses	Infestation Control	BT spray	2
Productivity of THLB	Maintain the Timber Harvesting Land Base	Surveys - all stages	1
		Site preparation	1
		Planting	1
		Brushing	1
	Increase Operability	Brushing - chemical	1
		Brushing – manual	1
Productivity Losses of NCBr.	Increase the Timber Harvesting Landbase	Surveys – all stages Site preparation Planting Brushing - manual Brushing - chemical	3
Productivity Losses in Riparian Management Zones	Increase Operability/Increase Yields	Surveys	4
		Brushing - manual	4

2.9.6.1 PRINCE GEORGE FOREST DISTRICT[18]

STUDY 1: OPERATIONAL FERTILIZATION MONITORING/FERTILIZER NUTRITION STUDY

FRBC Cost 2001/02

$60 000

FRBC Total Cost

$100 000 over 5 years.

Funding required for next 3 years

$75 000

Project Total Cost

This project will run for 15 years, with remeasurements every 3 years. Total cost $150 000

Partners Involved

Prince George Forest District, in partnership with Paul Sanborn (MoF - PG Region), Rob Brockley (MoF – Research Branc, Dunkley Lumber Ltd. and Canadian Forest Products Ltd.

Description

Our current knowledge of tree nutrition and fertilization response in the central interior rests on a very narrow base. Most temperate zone forests respond in varying degrees to added nitrogen, and forests of our region are no exception, as demonstrated by the existing trials involving mostly lodgepole pine. This information must be applied in pilot scale operational applications designed to test and expand the base of understanding. This study is supported by strong indications that stand fertilization in the Prince George TSA offers significant short, medium and longterm strategic benefits to resource supply. The results of this study will be fully portable to most of the TSA's within the Region.

Deliverables

This project will be implemented in tandem with future operational fertilization investments in the District, and provide an effective adapaptive management function for evaluating and modifying operational forest fertilization in the Region. Elements of this study compliment the proposals from the Vanderhoof Forest District (role of fertilzer Sulpur) by providing a replication in space as a basis for extrapolation throughout the TSA. Extension publications will be aimed towards local users.

STUDY 2: OPERATIONAL MONITORING OF MANUAL VEGETATION MANAGEMENT TREATMENTS (NIVMA PROGRAM PARTICIPATION)

FRBC Cost 2001/02

$30 000

FRBC Total Cost

$60 000

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[18] Studies are listed in order of importance within the Forest District

Funding required for next 3 years

$60 000

Project Total Cost

$100 000 over 5 years

Partners Involved

Ministry of Forests, Prince George Forest, Susan Hoyles, MoF, Prince George Region, in partnership with Canadian Forestry Products Ltd.

Description

In TSR1 the Chief Forester indicated that vegetation management issues could ultimately affect the mid-and long-term coniferous timber supply. Installation of NIVMA plots (3 installations in four major biogeoclimatic subzones) will be used to monitor various operational treatment regimes, aiding in future yield projections and timber supply determinations.

Deliverables

Locally useful silvicultural treatment resonse data suitable for predicting yield responses associated with manual vegetation management tactics within the Prince George Forest District. This data will also be fully portable to all supply blocks of the TSA.

STUDY 3: OPERATIONAL MONITORING OF BROADLEAF/CONIFER INTERACTIONS FOR MANAGED STAND DECISION SUPPORT

FRBC Cost 2001/02

$50 000

FRBC Total Cost

$150 000

Funding required for next 3 years

$150 000

Project Total Cost

$200 000 over 5 years

Partners Involved

Ministry of Forests, Prince George Forest, Susan Hoyles, MoF, Prince George Region, in partnership with Canadian Forestry Products Ltd.

Description

The operational significance of current free growing guidelines is not well understood. This project is aimed at exploring current policies and practices for prescribing silvicultural treatments to managed stands containing initimate mixtures of various broadleaf species. The project will provide an adaptive management function for evaluating and refining treatment practices to ensure that conifer production may be maintained at the least operational investment cost. The nature of this study is consistent with a high priority knowledge strategy recently identified in the Research Knowledge Gap review. The knowledge gained by this project directly supports the highest priority silvicultural strategies of all TSR;s in the Region.

Deliverables

Locally useful silvicultural treatment data suitable for predicting conifer yield responses and supporting operational prescription decision-making within the Prince George Forest District. This data will also be fully portable to all supply blocks of the TSA.

STUDY 4: EFFICACY OF HERBICIDE APPLICATIONS FOR OPERATIONAL BRUSHING (NIVMA PROGRAM PARTICIPATION)

FRBC Cost 2001/02

$30 000

FRBC Total Cost

$60 000

Funding required for next 3 years

$60 000

Project Total Cost

$100 000 over 5 years

Partners Involved

Ministry of Forests, Prince George Forest, Susan Hoyles, MoF, Prince George Region, in partnership with Canadian Forestry Products Ltd.

Description

In TSR1 the Chief Forester indicated that vegetation management issues could ultimately affect the mid-and long-term coniferous timber supply. Installation of NIVMA plots (3 per year) will be used to monitor various operational treatment regimes using RELEASE ad VISION forest herbicides.

Deliverables

Locally useful silvicultural treatment resonse data suitable for predicting yield responses associated with chemical vegetation management tactics within the Prince George Forest District. This data will also be fully portable to all supply blocks of the TSA.

STUDY 5: MONITORING OF SILVICULTURAL INTERVENTION IMPACT ON FUR-BEARER POPULATIONS AND THEIR HABITAT.

FRBC Cost 2001/02

$10 000

FRBC Total Cost

$30 000

Funding required for next 3 years

$30 000

Project Total Cost

$30 000 over 5 years

Partners Involved

Ministry of Forests, Prince George Forest, in partnership with local fur trapper representatives.

Description

The local impact of conventional silvicultural stand tending tactics on fur bearing mammal populations is not well understood. Forest Renewal Sustainable Harvest objectives emphasize the importance of biodiversity factors as indicators of resource sustainability. This project has local importance to this resource user-group.

Deliverables

Locally useful habitat impact information suitable for silvicultural operational planning. This data will also be fully portable to all supply blocks of the TSA.

STUDY 6: EFFICACY OF BACKLOG NSR SITE PREPARATION AND FILL-PLANTING TACTICS

FRBC Cost 2001/02

$10 000

FRBC Total Cost

$20 000

Funding required for next 3 years

$20 000

Project Total Cost

$40 000 over 5 years

Partners Involved

Ministry of Forests, Prince George Forest, Susan Hoyles, MoF, Prince George Region, in partnership with Canadian Forestry Products Ltd.

Description

Backlog NSR reforestation is a high priority silicultural strategy in all supply blocks of the Prince George TSA. This project will provide an adaptive management function for evaluating and refining various reforestation tactics associated with the backlog investment program. This will ensure the most cost-effective and biologically suited restocking investments are implemented.

Deliverables

Locally useful silvicultural treatment resonse data suitable for predicting yield responses associated with site preparation and stocking enhancement tactics within the Prince George Forest District. This data will also be fully portable to all supply blocks of the TSA.

STUDY 7: THE POTENTIAL OF ORGANIC (SEWAGE) BIOSOLIDS WASTE DISPOSAL ON GROWTH OF JUVENILE AND POLE STAND FOREST CROPS

FRBC Cost 2001/02

$10 000

FRBC Total Cost

$10 000

Funding required for next 3 years

$20 000

Project Total Cost

$20 000 over 5 years

Partners Involved

Ministry of Forests, Prince George Forest, Paul Sanborn, MoF Prince George Region, in partnership with Canadian Forestry Products Ltd. and the City of Prince George

Description

This study is a continuation of a biosolids disposal project initiated in 1998. There may be locally significant potential yield gains associated with this practice. This study establishes a direct link between the Prince George community and forest management practices in the TSA.

Deliverables

Potential yield improvement tactics and community waste disposal strategy.

2.9.6.2 VANDERHOOF FOREST DISTRICT[19]

STUDY 1: FOREST HEALTH OVERVIEW ASSESSMENT

FRBC Cost 2001/02

$48 000

FRBC Total Cost

$200 000

Funding required for next 3 years

$150 000

Project Total Cost

$200 000

Partners Involved

West Fraser Mills Ltd, Canadian Forest Products Ltd., Plateau Forest Products Ltd., L&M Lumber Ltd. and Ministry of Forests

Description

Pine stem rusts pose a significant risk to second growth lodgepole pine stands throughout the district. The purpose of this study is to identify high risk stands by elevation, aspect and biogeoclimatic site series. Identification of high risk stands will enable silviculturists to plan appropriate silviculture regimes for these areas. A pilot study has been conducted under the supervision of Richard Reich, Regional Pathologist, Ministry of Forests in the western portion of the district for the past two years. The District Silviculture Committee recommends that the study be expanded to cover the entire district, as funding allows. Expected duration of the study is 3 to 4 years. This project has direct linkage to the strategic and tactical priorities determined for the Prince George TSA, and the methodology and many of the interpretations will be fully transferable to the Mackenzie and Robson Valley TSA.

Deliverables

Map of high, moderate and low risk areas for hard pine stem rusts in the Vanderhoof Forest District.

Interim and final reports.

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[19] Studies are listed in order of importance in the Forest District

STUDY 2: SULPHUR FERTILIZATION OF LODGEPOLE PINE

FRBC Cost 2001/02

$35 000

FRBC Total Cost

$75 000 over 5 years.

Funding required for next 3 years

$50 000 per year.

Project Total Cost

This project will run for 20 years, with remeasurements every 3 years. Total cost $200 000

Partners Involved

Paul Sanborn (MoF - PG Region), Rob Brockley (MoF – Research Branch – in partnership with the University of Calgary, and West Fraser Mills Ltd, Canadian Forest Products Ltd., Plateau Forest Products Ltd., L&M Lumber Ltd. and Ministry of Forests

Description

Our current knowledge of tree nutrition and fertilization response in the central interior rests on a very narrow base. Most temperate zone forests respond in varying degrees to added nitrogen, and forests of our region are no exception, as demonstrated by the existing trials involving mostly lodgepole pine. However, the really important finding of recent work is that other nutrients, particularly sulphur, and occasionally boron, can also be limiting. Although S deficiency is a general problem across most of the interior, due to geological and environmental factors, only scattered and fragmentary knowledge of minor element status is available. Supplementing N with S has been shown to improve fertilization responses in pine in the SBS, and this finding has already influenced operational treatments. However, much needs to be learned regarding the duration of responses to elements other than N and the most effective forms in which to apply these other elements. This study is supported by strong indications that stand fertilization in the Prince George TSA offers significant strategic benefits to resource supply. The results of this study will be fully portable to most of the TSA's within the Region.

Deliverables

At the completion of initial analyses; establishment report and summary progress report.

Extension publication aimed at general forestry/silviculture audience.

Preparation and submission of journal article; conference presentation(s).

STUDY 3: RESPONSE OF OLD-GROWTH DEPENDENT MAMMAL SPECIES TO VARIABLE STAND DENSITY IN YOUNG LODGEPOLE PINE FOREST

FRBC Cost 2001/02

$15 000

FRBC Total Cost

$45 000

Funding required for next 3 years

$45 000

Project Total Cost

$185 000

Partners Involved

Thomas P. Sullivan, PhD, Director and Research Scientist, Applied Mammal Research Institute in partnership with Sustainable Forest Management Network, University of Alberta, Canadian Forest Products Ltd. - Grand Prairie, and local Vanderhoof stakeholders.

Description

Perhaps the greatest opportunity to diversify forests for the future lies in the vast areas of young second-growth stands, primarily lodgepole pine in the interior, which are amenable to silvicultural practices to accelerate ecosystem development. Pre-commercial thinning is a silvicultural tool that can enhance productivity of crop trees and stand structure. There are indications that some old-growth structural attributes may develop sooner in young stands, particularly at densities < 1000 stems/ha, rather than waiting many decades for these features to appear in unmanaged or high-density stands. Development of such structures may be crucial for some old-growth dependent mammal species. Examples include mule deer, northern flying squirrels, and red-backed voles. This study provides tactical knowledge support to high priority TSA strategies, and will be portable to other management units in the region. As well, it has been strongly endorsed as a high priority knowledge gap area in the recently released FRBC researchable issues report.

Deliverables

Provide scientific data on population dynamics of flying squirrels and red-backed voles and habitat use by deer in these variously treated stands.

By year 15 post-thinning, provide a measure of the capability of these thinned stands to sustain old-growth dependent species.

Input of these results into guidelines for thinning young lodgepole pine stands destined for accelerated development of old-growth features.

STUDY4: BIOLOGICAL EFFECTIVENESS OF MECHANICAL SITE PREPARATION

FRBC Cost 2001/02

$52 000

FRBC Total Cost

$52 000

Funding required for next 3 years

$100 000 ($20 000/year for remeasurement)

Project Total Cost

$230 000

Partners Involved

Brian Walker, Silviculturist, Fraser Lake Sawmills Ltd., Lorne Bedford, Forest Establishment Officer, Ministry of Forests and Ministry of Forests, Vanderhoof.

Description

This study is designed to assess the biological and cost effectiveness of disc trenching on a range of sites. Disc trenching has been used extensively within the Vanderhoof Forest District on a wide range of sites and the results in terms of seedling survival and growth have generally been very satisfactory. However, objective and well-documented comparisons between disc trenching and no site preparation in this area are lacking, and the cost effectiveness of this treatment has yet to be established. This project is designed to fill that gap, by comparing operational disc trenching with no site preparation at locations across a range of site series and associated site and soil properties. Site preparation response information is a key knowledge element in refining silvicultural tactics for both current reforestation and backlog NSR conversion, both of which are high priority tactics within the TSA.

Deliverables

Establishment reports will be submitted after each of the first three field seasons.

Growth and survival data will be analyzed and reported in years three, five and ten.

Progress report, including fifth year plantation performance data.

2.9.6.3 FORT ST. JAMES FOREST DISTRICT[20]

STUDY 1: FOREST HEALTH HAZARD MAPPING IN MANAGED STANDS

FRBC Cost 2001/02

$35 000

FRBC Total Cost

$200 000

Funding required for next 3 years

$55 000

Project Total Cost

$75 000

Partners Involved

Ministry of Forests in partnership with Apollo Forest Products and Canadian Forest Products Ltd.

Description

A strategy to increase timber quantity is to thin and fertilize moderately repressed 40-70 year-old pine stands. The full potential for this treatment is not yet known. Conservative estimates for thinning alone, which is currently being carried out on a limited basis in the Fort St. James District, are that stands will be available for harvest two decades earlier than with no treatment. A thinning program of 200 hectares per year for the next 10 years would provide 2000 hectares for harvest in the mid-term that would not otherwise be available.

Pre commercial thinning is considered for candidate sites close to existing mills which may have a positive benefit on harvest costs. The benefits of this activity would be to the timber supply in the medium and long term and improved timber quality.

Deliverables

Map of high, moderate and low risk areas for the key pests affecting resource supply in the Fort St. James Forest District.

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[20] Studies are listed in order of importance within the Forest District

STUDY 2: FERTILIZATION AND PRECOMMERCIAL THINNING IN FIRE ORIGIN PINE

FRBC Cost 2001/02

$36 120

FRBC Total Cost

$36 120

Funding required for next 3 years

$36 120

Project Total Cost

$75 000 over 15 years

Partners Involved

Canadian Forest Products Ltd.with the Ministry of Forests, Fort St. James District and Paul Sanborn, MoF Region.

Description

A strategy to increase timber quantity is to thin and fertilize moderately repressed 40-70 year-old pine stands. The full potential for this treatment is not yet known. Conservative estimates for thinning alone, which is currently being carried out on a limited basis in the Fort St. James District, are that stands will be available for harvest two decades earlier than with no treatment. A thinning program of 200 hectares per year for the next 10 years would provide 2000 hectares for harvest in the mid-term that would not otherwise be available.

Pre commercial thinning is considered for candidate sites close to existing mills which may have a positive benefit on harvest costs. The benefits of this activity would be to the timber supply in the medium and long term and improved timber quality. If in addition to the standard response there is an effect of helping the stand to overcome density related repression as has been observed in some younger stands, the benefits could be much greater. Potentially, MAI for the remainder of the rotation in these stands might be doubled. This project addresses a forest type and stand structure of most importance to the Fort St. James Supply Block, however the results of this study will be fully portable to similar stands throughout the SubBoreal Spruce biogeoclimatic zone.

Deliverables

Locally specific silicultural tactics for a major component of the silvicultural strategy in the district, and information pertinent to many other management units within and outside the region.

2.9.6.4 MACKENZIE FOREST DISTRICT

Please consult the Mackenzie Sustainable Resource Management Plan for recommendations on SH studies.

2.9.6.5 DAWSON CREEK FOREST DISTRICT

STUDY 1: OPERATIONAL MONITORING OF VEGETATION MANAGEMENT TREATMENTS (NIVMA PROGRAM PARTICIPATION)

Target Stands:

All pre-free growing stands in the TSA.

Expected Forest Level Benefits:

In TSR1 the Chief Forester indicated that vegetation management issues could ultimately affect the mid-and long-term coniferous timber supply. Installation of NIVMA plots (6 – 8 plots per year) will track success of various operational treatment regimes, aiding in future yield projections and timber supply determinations.

FRBC Cost 2001/02

$50 000

FRBC Total Cost

$150 000

Funding required for next 3 years

$150 000

Project Total Cost

$250 000 over 5 years

Partners Involved

Ministry of Forests, Dawson Creek District and Susan Hoyles, MoF, Prince George Region, in partnership with Canadian Forestry Products Ltd., West Fraser Timber Ltd., Louisiana Pacific Ltd.

Description

In TSR1 the Chief Forester indicated that vegetation management issues could ultimately affect the mid-and long-term coniferous timber supply. Installation of NIVMA plots (6 – 8 plots per year) will track success of various operational treatment regimes, aiding in future yield projections and timber supply determinations. This project is a local initiative fully linked to a high priority SH Research goal recently identified in the Research Knowledge Gap analysis.

Deliverables

Locally useful silvicultural treatment resonse data suitable for predicting yield responses associated with key silvicultural stategies for the TSA. This data will also be fully portable to the Fort St. John TSA.

2.10 MANAGEMENT CONSULTATION REPORTS

PRINCE GEORGE FOREST DISTRICT

District Planning Team Leader:

Bob Richards, Zone Officer

Table A-1 Forest Renewal Sustainable Harvest Consultation Report – Prince George Forest District[21]

Stakeholders	Method	Date	Response	RMP Issues Identified?	Steps for Resolution	Outstanding Issue?
Canadian Forest Products (Kerry Deschamps)	X Phone X Email X Meeting (Individual) X Meeting (group)	July 5,2000	YES	None	N/A	NO
Carrier Lumber Ltd. (Mike Trepanier)	X Email X Meeting (group)	July 5,2000	YES	None	N/A	NO

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[21] Agreement was reached with stakeholders in 2000 regarding the projected SH program to 2005.

Dunkley Lumber (Doug Perdue)	X Phone X Email	July 5,2000	NO	None	N/A	**NO**
Lakeland Mills Ltd. (Mike Joles)	X Email X Meeting (group)	July 5,2000	YES	None	N/A	**NO**
Thr Pas Lumber (Dan Upward)	X Phone X Email X Meeting (group)	July 5,2000	YES	None	N/A	**NO**
Prince George Woodlot Assoc. (Brian Harding)	X Phone X Email X Meeting (group)	July 5,2000	YES	None	N/A	**NO**

ROBSON VALLEY FOREST DISTRICT

Disrict Planning Team Leader:

Norma stromberg-jones, Forest Practices Code Officer

Table A-2 Forest Renewal Sustainable Harvest Consultation Report – Robson Valley Forest District[22]

Stakeholder[1]	Method[2]	Date[3]	Response?[4]	RMP Issues[5] Identified?	Steps for Resolution	Outstanding Issue?[6]
McBride Forest Industries Ltd. Craig Pryor	☒ Phone ☒ Email ○ Fax ○ Meeting (Individual) ○ Meeting (Group)	Sept 10 July 24 Sept 10	☒ YES ○ NO	Requested site index surveys be added.	FRBC will not fund stand-alone site index surveys. Instead, do along with free growing surveys.	NO
						NO
						NO
Slocan Forest Products Ltd. Marty Rombough	☒ Phone ☒ Email ○ Fax ○ Meeting	Sept 10 July 24 Sept 10	☒ YES ○ NO	Corporate commitment to employment should be increased from 2.61 to 2.8 for brushing, and decreased from 2 to 1 for backlog planting.	Change made to RMP	NO
				Pre-standtending surveys should be increased from 100 to 1000 ha.	Change made to RMP for 2002/03 and 2003/04.	NO

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[22] Agreement was reached with stakeholders in 2000 regarding the projected SH program to 2005.

	(Individual) ○ Meeting (Group)			Management unit summary table indicates that unit costs are too low.	None required. Explained to Marty that the summary table rolls up all activities and dollars from the enhanced and backlog tables to calculate total goals and average costs for all activities.	NO
Hauer Bros. Lumber Ltd. Ainslie Robson	☒ Phone ○ Email ☒ Fax ○ Meeting (Individual) ○ Meeting (Group)	Sept 10 July 24	☒ YES ○ NO	Ainslie Robson reported no issues.	Not applicable	NO
						NO
						NO
Ministry of sustainable resource management, Beryl Nesbit	☒ Phone ☒ Email ○ Fax ○ Meeting (Individual) ○ Meeting (Group)	Sept 10 July 24 Sept 10	○ YES ☒ NO	Beryl Nesbit did not respond to the request for review.	Not applicable	NO
						NO
						NO

VANDERHOOF FOREST DISTRICT

District Planning Chair:

Delee Anderson, Zone Forester, Silviculture

Table A-3 Forest Renewal Sustainable Harvest Consultation Report – Vanderhoof Forest District[23]

Stakeholders	Method	Date	Response	RMP Issues Identified?	Steps for Resolution	Outstanding Issue?
Plateau Forest Products Ltd. (Janice Thurston) L&M Lumber Ltd. (Peet Vahi) Canadian Forest Products Ltd. (Kerry Deschamps)* *participated by fax/speaker phone	☐ Meeting (Igroup	2000/09/12 13:30, AMS Office	☐ **YES**	Discussed activity tables, priority between backlog and enhanced program.	Stakeholders to review and provide input for appropriate activity levels.	**NO**
				Discussed upper limit for funding under SH component.	Adjust activity levels to achievable levels.	**NO**
				Discussed proposed silviculture studies for inclusion in RMP.	Some stakeholders to provide summaries of silviculture studies.	**NO**
Plateau Forest Products Ltd. L&M Lumber Ltd. Canadian Forest Products Ltd. West Fraser Mills Ltd. (Greg Van Dolah)	☐ **Email**	2000/09/15	☐ **YES**	Revised tables sent out for review as funding level above discussed limit.	Stakeholders to review and provide input.	**NO**
Plateau Forest Products Ltd.	☐ **Email**	2000/09/18	☐ **YES**	Email from Janice regarding which activities should be reduced to achieve funding limit.		**NO**

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[23] Agreement was reached in 2000 regarding SH plans up to 2005.

West Fraser Mills Ltd.	☐ **Phone**	2000/09/18	☐ **YES**	Phone call from Greg regarding activity levels to reduce.		**NO**
				Also discussed several silviculture study projects.	Greg to provide summary information.	**NO**
L&M Lumber Ltd.	☐ **Phone**	2000/09/18	☐ **YES**	Phone call from Peet regarding activity levels to reduce.		**NO**

FORT ST. JAMES FOREST DISTRICT

District Planning Chair:
Earl Wilson, Zone Forester

Table A-4 Forest Renewal Sustainable Harvest Consultation Report – Fort St. James Forest District[24]

Stakeholders	Method	Date	Response	RMP Issues Discussed	Steps for Resolution	Outstanding Issue?
UNBC-Canfor-S. Grainger Canfor-K. Deschamps MOF Research-C. DeLong MOF- L. Herring MOF-S. Salokannel All stakeholders were invited	☐ Phone ☐ Meeting (group)	July 7	☐ YES	SSFM Overview and direction	Formulate SSFM issues	NO
				Research presentation by C. Delong		
				K. Deschamps will sit on panel to sort priorities		
MOF LIM LRMP M. Slivitzky S . Salokannel	☐ Meeting (Individual)	July 10	☐ YES	Formulate SSFM issues		NO
Tim Silbernagle MOF John McInnes Tanizul P. Valk Canfor S. Flueck MOF DJA L.Pletzer S. Salokannel	☐ Meeting (group)	July 13	☐ YES	EEV issues		NO
				Plan process and identified work areas		
S. Flueck Canfor	☐ Meeting	July 13	☐ YES	SH; recreation; SSFM; FH		NO

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[24] Agreement was reached with stakeholders in 2000 regarding the projected SH program to 2005.

S. Salokannel MOF	(Individual)					
Aboriginal Forestry Advisor B. Goerz S. Salokannel MOF	☐ Meting (Individual)	July 17	☐	SSFM issues		NO
MOF recreation K. Wagner S. Salokannel MOF	☐ ☐ Meeting (Individual) ☐	July 17	☐	Recreation issues		NO
Stuart Lake Lbr. D. Muddiman S. Salokannel MOF	☐ ☐ Meeting (Individual) ☐	July 18	☐	SH SSFM EEV		NO
Apollo Forest Products J. Marchal S. Salokannel MOF	Phone	July 18		SH, SSFM, EEV		NO
K. Deschamps Canfor S. Salokannel MOF	Phone	July 18		Using spread sheet from B. Richards		NO
Tanizul -P. Valk S. Salokannel MOF	Meeting (Individual)	July 18		Explained template for RMP submission		NO
Tanizul P. Valk	Phone Email (group)	July 20		Peter Valk submitted plan for goals and investment		NO
Canfor S. Flueck	Phone	July 26		Due to Canfor's late start with program they are having difficulty planning for next year's program		NO
Canfor S. Flueck	Phone	July 27		Canfor is too busy to provide input to RMP		NO

Stuart Lake Lumber	Meeting (Individual)	Aug. 15		SSFM - provide help in how to fill out 'issues forms'		NO
Canfor Apollo	Phone	Aug. 16	NO			NO
B. Baker SNWA	Phone Email	Aug. 16		Instructions re: template		NO
MOF, LIM, Aboriginal Affairs and SBFEP	Meeting (Individual)	Aug. 16		Explanation of criteria for SSFM		NO
Village of Fort St James Community Forest	Meeting (Individual)	Aug. 17		Explanation of criteria		NO
UNBC -Canfor	Phone	Aug. 17		Ensure input to Canfor's plan		NO
MOF, LIM, Aboriginal Affairs	Meeting (Individual)	Aug. 17		Help formulate issues		NO
Canfor	Phone Email	Aug. 17		Submitted FRBC goals & investment plan as a rough estimate.		NO
Community Forest	Phone	Aug. 18		SSFM issues		NO
B. Baker SNWA	Email	Aug. 18		How to fill out template		NO
Diane Reed MOF Rec	Meeting (Individual)	Aug. 29		Recreation opportunities spectrum		NO
Stuart Lake Lbr. -D. Muddiman	Phone	Sept. 5		Follow up on RMP input Introduced Brandon McDonald		NO
B. Goerz	Email	Sept. 6		Arch project – Level of detail?		NO

MACKENZIE FOREST DISTRICT

Please consult the Mackenzie Sustainable Resource Management Plan (MSRMP) in the Appendix for a description of the collaboration and consultation process.

DAWSON CREEK FOREST DISTRICT

District Planning Chair:

Frank McAllister, Silviculture Officer

Table A-5 Forest Renewal Sustainable Harvest Consultation Report – Dawson Creek Forest District[25]

Stakeholders	Method	Date	Response	RMP Issues Identified?	Steps for Resolution	Outstanding Issue?
Mike Byl, Louisiana-Pacific Canada Corp.	☑ Phone ☑ Email	July 19, 2000	☑ YES ☐ NO			NO
Carl Jahn, SBFEP	☑ Phone ☑ Email	July 19, 2000	☑ YES ☐ NO			NO

---

[25] Agreement was reached with stakeholders in 2000 regarding the projected SH program to 2005.

Brian Pate, Don Scott Chetwynd Forest Industries (West Fraser Mills)	☑ Phone ☑ Email	July 19, 2000	☑ YES ☐ NO			NO
Wes Neumeier, Dennis Sabourin Canadian Forest Products Ltd.	☑ Phone ☑ Email	July 19, 2000	☑ YES ☐ NO			NO
Rod Backmeyer, BC Environment	☑ Phone ☑ Email	July 19, 2000	☑ YES ☐ NO			NO

FORT ST. JOHN FOREST DISTRICT

District Planning Chair:

Brian Farwell, FRP Silviculture Officer

Table A-6 Forest Renewal Sustainable Harvest Consultation Report – Fort St. John Forest District[26]

Stakeholders	Method	Date	Response	RMP Issues Identified?	Steps for Resolution	Outstanding Issue?
Scott Gordon Canadian Forest Products Ltd.	☐ Phone	September 13, 2000	☐ YES	None	N/A	NO

---

[26] Agreement was reached with stakeholders in 2000 regarding the projected SH program to 2005.

2.10.1.1 FORT NELSON FOREST DISTRICT

District Planning Chair:

Alena Terry, FRP Forester

Table A-7 Forest Renewal Sustainable Harvest Consultation Report –Fort Nelson Forest District[27]

Stakeholders	Method	Date	Response	RMP Issues Identified?	Steps for Resolution	Outstanding Issue?
Slocan Forest Products Ltd. Contact: Mary Duda	X Phone X Email X Meeting (Individual)	August 9, 2000	X YES ☐ NO	Defining what the Legal Obligations and Critical Backlog is.	Working together on the definitions	NO
				Backlog areas which must be funded while the VRI proceeds for the Fort Nelson District, for the next 3-4 years	Reconnaissance of Backlog areas to determine critical areas which require funding during the VRI process.	YES

---

[27] Agreement was reached with stakeholders in 2000 regarding the projected SH program to 2005.

2.11 MACKENZIE SUSTAINABLE RESOURCE MANAGEMENT PLAN

See Appendix 2 of the attached document Strengthening Sustainable Forest Management

BRITISH
COLUMBIA

the Ministries of

Forests
Water, Air and Land Protection
Sustainable Resource Management

RESOURCE MANAGEMENT PLAN

2002-2007

Volume II

Strengthening Sustainable Forest Management

prepared for

FOREST
RENEWAL BC

on behalf of the

Omineca-Peace

and

Prince George Forest Regions

FOREST SERVICE
BRITISH COLUMBIA

SECTION 1

INTRODUCTION TO STRENGTHENING SUSTAINABLE FOREST MANAGEMENT PLANNING

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SECTION 1

INTRODUCTION TO STRENGTHENING SUSTAINABLE FOREST MANAGEMENT PLANNING

REGIONAL CONTEXT

The Strengthening Strategic Forest Management (SSFM) strategic objective addresses the need for improved forest ecosystem knowledge, management techniques and innovations necessary to attain sustainable forest management.

During its first five years, Forest Renewal invested in knowledge aimed at operational level forest planning and management. This was necessary to implement the new policies and practices of the Forest Practices Code. Investments were primarily inventory projects, administered through the Inventory Program. Beginning in 2001/02, and continuing in 2002/03 the SSFM strategic objective shifts investment focus from operations to higher-level strategic decisions and planning processes, thereby requiring a broad range of investment activities. While inventory investments remain part of the SSFM program, they are redirected to strategic-level issues, planning needs and decision-support.

Sustainable forest management (SFM) and ecosystem management are synonymous. Successful SFM requires a management approach that recognises an integrated set of forested ecosystem variables, which in turn determine environmental, socio-economic and cultural values and forest benefits. SFM principles consider a wide range of timber and non-timber resource elements, including species and habitat diversity, soil and water conservation, forest ecosystem structure and function at the local, regional and global level, as well as the many societal benefits forests provide. SFM also considers the participatory roles and rights of forest dependent communities and First Nations.

The Forest Renewal BC SSFM objective focuses specifically on knowledge acquisition aimed at two aspects of sustainable forest management: maintenance of environmental values and resource benefits (including traditional {timber} and non-traditional forest products, and eco-tourism). Investments in improved knowledge must be at the higher planning levels of management, namely the forest or landscape levels and must therefore focus at the strategic, rather than the operational (site or stand) level of resolution, for improved SFM decision-making. SSFM investments within the 2002/2003 RMP will provide forest managers with new or improved knowledge about the impacts of alternative management practices on forest ecosystem processes, functions, values and benefits. Investment priority favours knowledge aimed at the maintenance of environmental and resource values most at risk from forest management decisions.

PLANNING FRAMEWORK

The document *"2002-03 Resource Management Terms of Reference"* (Appendix Section 5) jointly developed by the Ministries of Forests, Water, Air and Land Protection, and Sustainable Resource Management, the Northern Forest Products Association and Forest Renewal BC for the Omineca-Peace Region defines the general planning framework for Resource Management Planning. Three principles underlie the SSFM planning process in the Omineca-Peace Region:

- the Planning Committee personnel, the planning process, and the final SSFM Regional RMP must have the approval and support of senior managers from the three resource agencies, the Northern Forest Products Association, and Forest Renewal BC;

- the Technical Planning Committee will appoint leading technical specialists in each issue as Chair/Co-chairs of Tactical Planning Teams, with the acknowledgement and support of senior managers from the three resource agencies and the NFPA. The process and final plan must reflect a collaborative effort involving resources agency staff and key Forest Renewal stakeholders;
- chair/co-chairs for each Tactical Planning Team are responsible for team organisation, planning activities and Tactical Plan documentation, based on the format and content requirements in the SSFM Guidelines.

A hierarchical planning framework with assigned planning roles was adopted as the best means of adhering to these planning principles. Figure 1.1 illustrates the three level process defined in the *Omineca-Peace RMP Terms of Reference* (formerly Ground Rules). The planning roles at each level of the hierarchy are briefly described, subsequently.

RMP STEERING COMMITTEE

Level 1 of the planning hierarchy consisted of a multi-agency steering committee responsible for ensuring all three components (SH, SSFM and EEV) of the Regional RMP were undertaken according to the approved planning guidelines, and within the overall planning timeframe.

Forest Renewal BC, Omineca-Peace Region; the Northern Forest Products Association, the Ministry of Forests, Prince George Region; and the Ministries of Water, Air and Land Protection, and Sustainable Resource Management, Omineca-Peace Region each appointed representatives to serve on the RMP Steering Committee. The role of this committee in SSFM planning was to facilitate agency support for the SSFM Technical Planning Committee (see Figure 4.1.1. The RMP Steering committee:

- recommended SSFM committee membership;
- monitored the planning progress and communicated committee achievements and planning resource requirements to the senior managers;
- ensured that appropriate, collaborative input was incorporated into the SSFM plan;
- ensured that adequate staff support resources from all organisations were made available; and
- ensured that critical timeframes for plan completion were met.

RMP Steering Committee members, and the reporting relationship of each Committee member is described in Table 1.1.

Table 1.1 RMP Steering Committee membership and reporting relationship

Committee Member	Responsible to:
Bill Jensen, Investment Officer FRBC OP region	Joyce Beaudry, Director FRBC OP Region
Leslie Yaremko, FRBC Planner SRM/MWALP, OP Region	Wally Eamer Director, MWALP, OP Region Phil Zacharatos Director, MSRM, OP Region.
Joe Kavanagh FRBC Planner, Canadian Forest Products Ltd.	Doug Routledge Manager, Northern Forest Products Association
Les Herring, FRBC Planner, MoF, Prince George Region	Ray Schultz, Regional Manager, MoF, Prince George Region

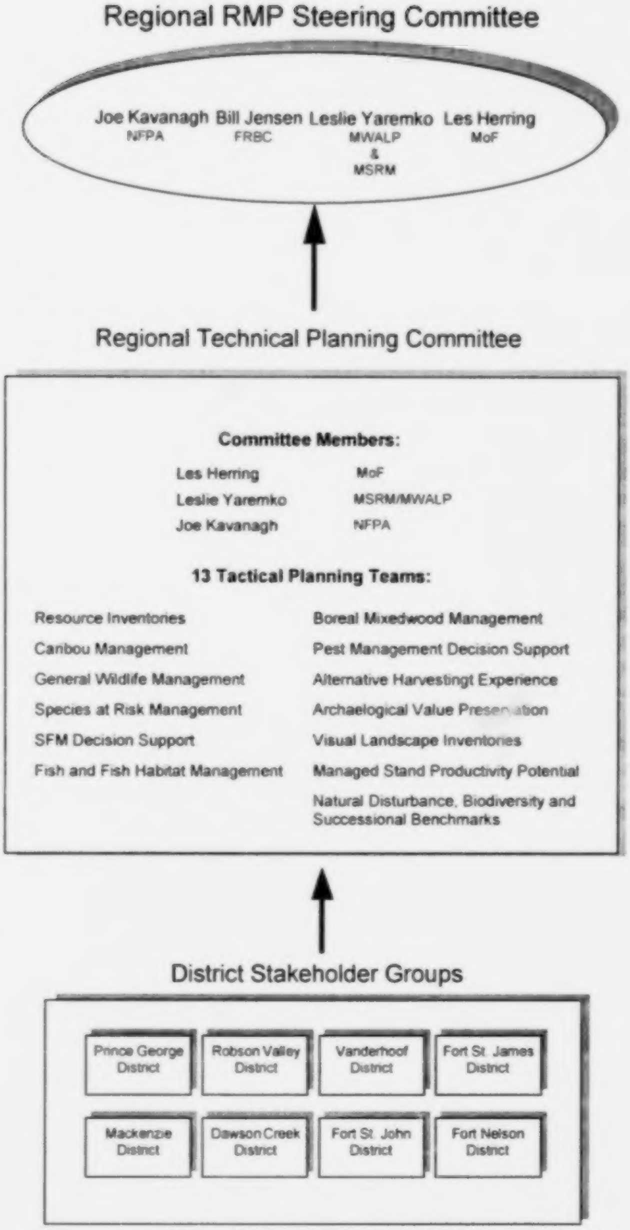
Regional RMP Steering Committee
Joe Kavanagh
NFPA
Bill Jensen
FRBC
Leslie Yaremko
MWALP
&
MSRM
Les Herring
MoF
Regional Technical Planning Committee
Committee Members:
Les Herring MoF
Leslie Yaremko MSRM/MWALP
Joe Kavanagh NFPA
13 Tactical Planning Teams:
Resource Inventories
Caribou Management
General Wildlife Management
Species at Risk Management
SFM Decision Support
Fish and Fish Habitat Management
Boreal Mixedwood Management
Pest Management Decision Support
Alternative Harvestingt Experience
Archaelogical Value Preservation
Visual Landscape Inventories
Managed Stand Productivity Potential
Natural Disturbance, Biodiversity and Successional Benchmarks
District Stakeholder Groups
Prince George District
Robson Valley District
Vanderhoof District
Fort St. James District
Mackenzie District
Dawson Creek District
Fort St. John District
Fort Nelson District

Figure 1.1 **The hierarchical structure of the SSFM planning exercise.**

Each member of the Committee represented the interests of their respective Regional Director, Regional Manager or manager (or designate), to ensure that all terms of the Services Agreement between Forest Renewal BC and the two agencies were fully satisfied in the plan.

REGIONAL TECHNICAL PLANNING COMMITTEE

Level 2 of the SSFM planning hierarchy consisted of a technical planning committee, and planning teams composed of resource specialists. The primary role of the Regional Technical Planning Committee was to identify, prioritise and analyse key SSFM issues, and to develop knowledge solution strategies and and investment projects within the Omineca/Peace Region. This role was fulfilled during two phases: in 2000 the key issues were identified and provisional knowledge strategies were developed; and in 2001 the issues underwent comprehensive analysis and final strategies and tactics recommended.

During each year of the two-year term of SSFM planning the steering committee consisted of a representative from each resource agency, the Interagency Management Committee (2001/02 only), and the Northern Forest Products Association. The Regional SSFM Technical Planning Committee membership and term of service over the two years preparation of this SSFM plan is presented in Table 1.2.

Table 1.2 SSFM Technical Planning Committee membership and reporting responsibility.

Committee Member	Representing:	Term of Service:
Leslie Yaremko Forest Renewal Co-ordinator, MWALP/MSRM, Omineca-Peace Region	MWALP/MSRM, Omineca Peace Region	July, 2001 to present
Les Herring FRBC Planner, MoF, Prince George Forest Region	Ministry of Forests, Prince George Forest Region	April 2000 to present
Joe Kavanagh FRBC Coordinator Wood Products - Prince George Operations Canadian Forest Products Ltd	Northern Forest Products Association	April 2001 to present
Kerry Deschamps Planning Forester, Prince George Operations Canadian Forest Products Ltd	Northern Forest Products Association	April 2000 to March 2001
Beryl Nesbit Habitat Biologist, MoELP (now MWALP), Omineca-Peace Region	MoELP, (now MWALP) Omineca Peace Region	April 2000 to March 2001
Andra Bismanis Habitat Biologist, MWALP), Omineca-Peace Region	MWALP, Omineca Peace Region	April 2001 to June 2001
Dick Nakatsu Senior Inventory Officer, MoF, Prince George Forest Region (now MSRM)	Ministry of Forests, Prince George Forest Region	April 2000 to March 2001
Dan Adamson Interagency Management Advisory Committee Chair, LUCO (now MSRM)	Land Use Co-ordinating Office	April 2000 to March 2001

DISTRICT PLANNING TEAMS

Level 3 of the planning hierarchy consisted of 8, local planning committees. The primary role of the District Planning Teams was to assist the Regional SSFM Technical Planning Committee in the identification and description of SSFM issues. Their role was fulfilled in 2000, as reported in the 2001/02 RMP.

In this initial planning phase, each Forest District organised an SSFM planning team, the structure and membership of which remained at the discretion of the District Manager, while meeting the intent of the 2001/02 *Ground Rules* regarding the involvement of key, local stakeholders. District Planning Teams, throught local stakeholder collaboration, provided local context and priority ranking to SSFM issues of regional significance. Individuals from District Planning Teams also served on Regional Tactical Planning Teams during the second phase of planning, and by reviewing and commenting on project investment solutions and the draft SSFM Resource Management Plan.

Table 1.3 identifies the forest district officers who chaired the District planning teams.

Table 1.3 District Planning Team Chairs

District	District Officer	Position
Prince George	Mr. Bob Richards	Zone Officer
Robson Valley	Ms. Norma Stromberg-Jones	Forest Practices Code Officer
Vanderhoof	Mr. Norm Fallows[1] Mr. Dave Sommerville	Watershed Restoration Technician District Silviculturist
Fort St. James	Ms. Susan Salokannel	Zone Forester
Mackenzie	Mr. Steve Dodds	District Planning Officer
Dawson Creek	Ms. Winn Hays-Byl	Integrated Resource Analysis Planner (now MSRM)
Fort St. John	Mr. Brian Farwell	Forest Renewal Silviculture Officer
Fort Nelson	Ms. Alena Terry[2]	FRBC Forester

THE PLANNING PROCESS

The planning process occurred in two phases, occurring over two years, beginning in April, 2000, and ending in September, 2001:

PHASE 1 - PREPARATION AND ISSUE IDENTIFICATION

Development of SSFM Regional Framework

In July, 2000 the Regional Technical Planning Committee developed a frame of reference to guide the planning process of district planning teams. This key document provided a consistent context, content and format for soliciting local SSFM priorities from all 8 management units, and established the basis for developing the Regional SSFM RMP. Appendix 4.1 contains the frame of reference package for one of the eight forest districts in the region. This package should be reviewed by FRBC investment officers prior to considering the recommendations in this RMP, since the context of the planning exercise must be clearly understood by users of this Resource Management Plan. The Frame of Reference package was distributed to all SSFM planning chairs in the eight management units on August 2, 2000.

Submission of Local SSFM Issues

The narrow time frame for completion of planning was problematic for most districts. In spite of stakeholder work schedules, submissions were received by September 8 from all forest districts, thereby completing this phase of the planning process.

Ranking of District SSFM Issues

The Regional Technical Planning Committee began the task of reviewing and consolidating local issues on August 22-23, and continued the process from 1 to 2 days each week until September 15. The steps of the process are described subsequently

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[1] Replaced by Mr. Dave Sommerville August 15, 2000.

[2] Replaced Ms.Ljiljana Knezevic during mid-July, 2000

Screening of all SSFM Issues

Initial screening of district submissions began as soon as they were received. In several cases, submissions were returned to district planning teams for modification, clarification, or additional input. This was largely due to the shift from a project oriented RMP to a consideration of root issues. After final review, approximately 5 "issues" received from a variety of sources were discarded for failure to follow the frame of reference instructions. In general, however, submissions were thoughtfully prepared, and of high technical quality. In a few cases, complex issues were "split" by the committee into separate issues. Table 1.4 indicates the number of acceptable issues received from each of 9 sources. All submissions were entered into a regional database that was used for later scoring and ranking.

Table 1.4 Distribution of issues by source.

Source	Number of Issues
Prince George District	10
Robson Valley District	15
Vanderhoof District	23
Fort St. James District	12
Mackenzie District	12
Dawson Creek District	11
Fort St. John District	9
Fort Nelson District	12
Regional Issues[3]	12
Total Solicited Issues	116

The Ranking Procedure

The Regional Technical Planning Committee developed a 9 criteria issue-rating scheme for use in ranking each issue as submitted. These criteria represent most of the considerations identified in the 2001/02 SSFM Guidebook (page 27 "Considerations for Assessing the Priority of SSFM Issues"), as well as others the committee felt reflected relative investment value. These criteria are described in Table 1.5.

Committee members reviewed the 116 district issues, and independently assigned a score for criteria 2, 3, 4, 5, 6, 7 and 9. Independent scores were subsequently discussed and adjusted to reflect a committee consensus. Inter-agency Planning Team members were then consulted to assign a rank to criteria 1. In cases where an IPT member was involved in SSFM issue preparation, an alternate member was consulted. A keyword search of the issue database was used to score criteria 8; relative commonality in issues and knowledge gaps determined the score assigned. The regional scores for the 116 issues are presented in Table A-1 in the Appendix.

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[3] Issues received from regional headquarters staff of both resource ministries; some were district-specific, others were of regional context; all were assigned to the appropriate management units and evaluated with District Planning Team submissions.

Table 1.5 Regional SSFM Criteria for ranking District Issues.

Criteria: question	Explanation	Score & *Weight
LRMP: how well does the issue relate to high priority issues identified in an approved LRMP?[4]	The LRMP provides comprehensive stakeholder participated, government approved direction, and is an excellent reference source for identified resource issues.	0-5 *2
CCFM: how well does the issue relate to the 6 criteria [5], 22 elements[6] and indicators represented in the Canadian Council of Forest Ministers' report "Sustainable Forests: A Canadian Commitment?	The Canadian Council of Forest Ministers' criteria are an important initiative that is linked to national goals for sustainable forestry certification.	0-5 *2
TSR: how well does the issue relate to timber supply review issues?[7]	Forest level issues identified in the timber supply planning process are strategic in nature, and are considered high in priority to SSFM planning	0-5 *2
Success: will the scope of the issue ensure a high probability of achieving a solution through knowledge investment?	The SSFM issue must be reasonable in scope, permitting any knowledge investments to yield satisfactory and measurable resolution.	0-5 *1
Stakeholders: will knowledge solutions to this issue benefit a variety of stakeholders?	If the issue is too narrowly focused and specific to a single interest it may have limited community benefits. Issue resolving investments should benefit a number of interest or stakeholders.	0-5 *1
Linkage: is the issue linked to a variety of management disciplines?	Knowledge investment return will be maximised for issues which affect a number of decision-makers, planners, agencies, and stakeholders.	0-5 *1
Policy: does the issue link to (or influence) factors which are driving policy change?	Issues which result in pressure to review or change government policies may be indicative of real, pertinent, current issues. Issues relating to pressures for change may be of importance at various levels of government. Solutions to these issues can provide valuable input for policy change reviewers and decision-makers.	0-5 *1
Commonality: has the issue been identified in other management units?	Issues common to a number of administrative jurisdictions may reflect greater importance. Solutions derived in one jurisdiction that may be extrapolated to other forests increase knowledge investment return.	0-5 *1
Urgency: does the issue reflect an urgent need for resolution and improved decision-making?	A higher priority may be appropriate for those issues which are delaying or preventing important decisions, particularly if it is a recurring issue.	0-5 *1
	Maximum Issue Score	60

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[4] All management units in the Prince George Region, except Mackenzie, have completed and approved LRMP's. The Mackenzie plan is currently undergoing final review and ratification.

[5] 1. Conservation of biological diversity; 2. Maintenance and enhancement of forest ecosystem condition and productivity; 3. Conservation of soil and water resources; 4. Forest ecosystem contributions to global ecological cycles; 5. Multiple benefits to society; 6. Accepting society's responsibility for sustainable development.

[6] Ecosystem diversity; Species diversity; Genetic diversity; Disturbance and stress; Ecosystem resilience; Extant biomass; Physical environmental factors; Policy and protection forest factors; Global carbon budget; Forest land conversion; Carbon dioxide conservation; Policy factors; Hydrological cycles; Productive capacity; Competitiveness; Contribution to economy; Non-timber values; Aboriginal and treaty rights; Participation by Aboriginal communities; Sustainability of forest communities; Fair and effective decision making; informed decision-making.

[7] Documented in: Forest Management Issues Identified Through the AAC Determination Process – TSA/TFL Timber Supply Reviews: 1992:1996. Timber Supply Branch, BC Ministry of Forests, December, 1996.

Key Regional SSFM Issues

Selection of Key Regional Issues was entirely based on the rankings of individual district submissions. The Technical Planning Committee reviewed a total of 116 individual responses. These submissions were consolidated where common issues from several sources were received. All issues were priority ranked. Issues ranked in the top 50% were then identified as *Key Issues*. A total of 13 such Key Issues were identified from the 116 Issue submissions. Each issue is identified by the following priority numbering sequence:

- Unreliable Forest Resource Inventories;
- Incomplete Caribou Management Objectives;
- Lack of Species-at-Risk Management Objectives;
- Lack of General Wildlife Habitat Management Objectives;
- Unknown Natural Disturbance, Biodiversity and Natural Successional Dynamics Benchmarks;
- Inadequate Sustainable Forest Management Decision Support Tools;
- Incomplete Fish and Fish Habitat Management Objectives;
- Incomplete Understanding of Boreal Mixedwood Stand Dynamics and Management;
- Lack of Specific Pest Management Decision Support Tools;
- Lack of Alternative Harvesting Experience;
- Lack of Archaeological Value and Preservation Objectives;
- Incomplete or Outdated Visual Landscape Inventories;
- Inadequate Understanding of Managed Stand Site Productivity Potential.

PHASE 2 – ISSUE ANALYSIS AND STRATEGIC AND TACTICAL SOLUTION PLANNING

Beginning in April 2001, the Regional Technical Planning Committee re-formed to address the second phase of SSFM planning. Following provincial development of the 2002/03 SSFM RMP Guidelines the committee nominated a slate of technical specialists to serve as chair/co-chairs of Tactical Planning Teams to address each of the 13 key issues. A senior manager's meeting was held in early June to obtain approval of these nominations. Table 1.6 identifies the individuals and their lead assignments.

Recommendations from each Technical Planning Team form the content of Section 2 (a summary of key recommendations) and Section 3 (detailed strategic, tactical and operational level knowledge investment recommendations).

Table 1.6 Regional Tactical Planning Team Leaders

Key SSFM Knowledge Gap Issue	Planning Team Chair/Co-chair	Affiliation
1. Incomplete Forest Resource Inventories	Dick Nakatsu	Inventory Specialist, Ministry of Sustainable Resource Management, Prince George
2. Incomplete Caribou Management Objectives	Doug Heard	Head of Wildlife, Ministry of Water, Air and Land Protection, Prince George
3. Lack of Species-at-Risk Management Objectives	Doug Wilson	Wildlife Habitat Inventory Specialist, Ministry of Sustainable Resource Management, Prince George
4. Lack of General Wildlife Habitat Management Objectives	Doug Wilson	Wildlife Habitat Inventory Specialist, Ministry of Sustainable Resource Management, Prince George
5. Unknown Natural Disturbance, Biodiversity and Natural Successional Dynamics Benchmarks	Joe Kavanagh Craig DeLong	FRBC Coordinator, Canadian Forest Products Ltd., Prince George Regional Ecologist, Ministry of Forests, Prince George
6. Inadequate Sustainable Forest Management Decision Support Tools	Joe Kavanagh Bill LaForge	FRBC Coordinator, Canadian Forest Products Ltd., Prince George Vanderhoof IFPA Manager (Avison Management Ltd.), Vanderhoof
7. Incomplete Fish and Fish Habitat Management Objectives	Lynn Blouw Jeff Burrows	Fish and Fish Habitat Inventory Specialist, Ministry of Sustainable Resource Management - Omineca, Prince George Fish and Fish Habitat Inventory Specialist, Ministry of Sustainable Resource Management – Peace, Fort St. John
8. Incomplete Understanding of Boreal Mixedwood Stand Dynamics and Management	Richard Kabzems	Research Silviculturist, Ministry of Forests, Fort St. John
9. Lack of Specific Pest Management Decision Support Tools	Richard Reich Bob Hodgkinson	Regional Forest Pathologist, Ministry of Forests, Prince George Regional Forest Entomologist, Ministry of Forests, Prince George
10. Lack of Alternative Harvesting Experience	Marty Rombough Barry Thorpe	Forester, Slocan Forest Products Ltd. Valemount Forester, Canadian Forest Products Ltd., Fort St. James
11. Lack of Archaeological Value and Preservation Objectives	Heather Moon John Gray	Cultural Heritage Consultant, Victoria Regional Aboriginal Affairs Manager, Ministry of Forests, Prince George
12. Incomplete or Outdated Visual Landscape Inventories	Luc Roberge	Regional Landscape Planner, Ministry of Forests, Prince George
13. Inadequate Understanding of Managed Stand Site Productivity Potential	Larry Badowski	Regional Growth and Yield Officer, Ministry of Sustainable Forest Management

THE MACKENZIE STRATEGIC RESOURCE MANAGEMENT PLAN

Included in Appendix 2 of this RMP is a copy of a locally derived resource management plan. The Mackenzie Strategic Resource Management Plan (MSRMP) was developed by during the same period as the regional Sustainable Harvest (SH), Enhancing Environmental Values (EEV) and Strengthening Sustainable Resource Management (SSFM) Plans. It was commissioned by FRBC as a pilot project aimed at local forest resources investment planning.

MSRMP was prepared by members of the Mackenzie TSA RMP Planning Group, consisting of representatives from the Ministry of Forests, Ministry of Water, Land and Air Protection, Ministry of Sustainable Resource Management, Abitibi Consolidated, Slocan Forest Products and Forest Renewal BC. The Plan was approved by the Mackenzie Senior Managers Group, which includes representation from all organisations on the Mackenzie TSA RMP Planning Group with the exception of Forest Renewal BC.

The MSRMP incorporates regional SSFM issues and investment strategies with local issues and priorities in a five-year strategic planning framework. The objective of this pilot SRM planning process was to provide increased local flexibility to assist the Planning Group in reaching agreement on investment priorities. Greater flexibility in the timing and outputs of investment initiatives within a five-year timeframe was encouraged, consistent with Forest Renewal BC's targets and priorities.

The Mackenzie SRMP process is unique in that it is a multi-stakeholder, consensus-based process that identifies multi-year priorities based upon an assessment of issues that are of significance to sustainable forest management in the Mackenzie TSA. The process addresses the traditional boundaries of Forest Renewal BC's strategic objectives, but goes beyond them in terms of developing strategic priorities that provide long term solutions that are directly applicable to the issues and objectives in the Mackenzie TSA. Included in the MSRMP document is a detailed description of the planning process, which may be helpful to other local planning groups wishing to undertake a similar strategic planning exercise.

SECTION 2

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SECTION 2

KNOWLEDGE ISSUES AND RECOMMENDED INVESTMENT SOLUTIONS

Thirteen Tactical Planning Teams submitted their analysis of each knowledge gap issue, as well as detailed recommendations for specific corrective knowledge investments. This input was received in template format (Templates 1-3) with investment detail usually to the activity level. A total of 217 separate investment recommendations were developed. In order to compile all recommendations in a consistent format, and to facilitate the summary of strategies in this section, recommendations were grouped according to the hierarchical model illustrated in Figure 2.0.1.

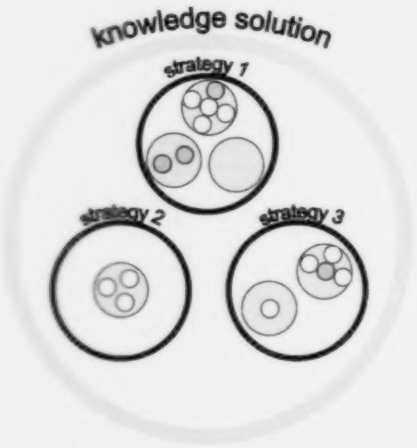

Figure 2.0.1. Hierarchical classification model used to group investment recommendations within Issues

The overall solution (green circle) for each knowledge gap issue consisted of:

- Two or more major investment strategies requiring a medium to long term investment commitment (black circles);
- One or more key investment tactics (green spheres) which, together, are required for full implementation of the knowledge strategy;
- Where sufficient detail was provided, one or more broad-scale activity investments (red spheres) crucial to the success of the tactic, OR one or more specific project investments (yellow spheres) of similar importance.

A summary of the knowledge solutions recommended for each knowledge gap issue follows.

ISSUE 1 UNRELIABLE FOREST RESOURCE INVENTORIES

Sustainable forest management depends on realistic and achievable objectives based on societal values, tempered by thorough knowledge of resource management opportunities and constraints. An accurate, scientifically based accounting of the physical and spatial attributes of forest resources (structure, composition, size, location and dynamics) is therefore a prerequisite for successful SFM.

There are a large number of forest resources inventories, ranging from 100% landbase coverage, such as vegetation cover inventories, to selected special features inventories, such as recreation sites and unstable terrain. In order to undertake a practical analysis of the problem, the scope of the resource inventories issue has been limited to four *Core Inventories*:[1]

- Vegetation resources;
- Ecological characteristics;
- Recreation features;
- Soils and surficial geology resources.

All four, core inventories are inadequate, to varying degrees, to fully support SFM planning. Local inventories for many management units are either substantially out-of-date, or incomplete, resulting in unacceptably low accuracy and reliability. The success of SFM depends on up-to-date, accurate and statistically valid resource data as a basis for realistic SFM supply forecasts. This demands a comprehensive inventory system that reflects the state and rate of change of each resource being managed.

Three additional factors add complexity to the design of a suitable resource inventory knowledge strategy:

- the Omineca-Peace forested land base is enormous in extent;
- the quality of local inventories is highly variable;
- the required resolution of SFM planning is the individual management unit (TSA and TFL).

As a result, the recommended forest resource inventory solution is inventory type and management unit specific.

RECOMMENDED RESOURCE INVENTORIES KNOWLEDGE SOLUTION

Four, key, regional knowledge strategies are recommended that will, if implemented fully, resolve the current inadequacies of the four core forest resource inventories. The success of these strategies, however, depends on the availability of the Terrain Inventory Information Management (TRIM2) map base. This topographic and contour inventory system is an essential prerequisite to all map-based inventories, and therefore must be completed prior to implementation of the following regional strategies. Figure 2.1.1 illustrates the structure of the recommended inventories knowledge solutions. A full, technical description of the recommended strategies is found in Section 3.

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[1] Other forest resources inventory needs are reflected in the recommendations of the remaining 12 knowledge issues (i.e. wildlife species inventories, archaeology features inventories, visual landscape inventories). They reflect a lower, overall priority, compared to the *Core Inventories*.

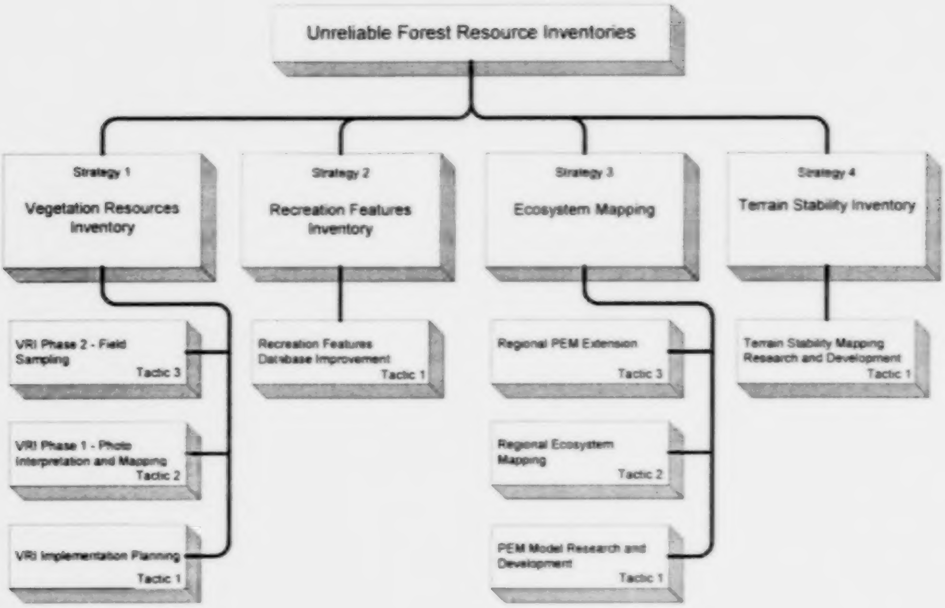
Unreliable Forest Resource Inventories
Strategy 1
Vegetation Resources Inventory
Strategy 2
Recreation Features Inventory
Strategy 3
Ecosystem Mapping
Strategy 4
Terrain Stability Inventory
VRI Phase 2 - Field Sampling
Tactic 3
VRI Phase 1 - Photo Interpretation and Mapping
Tactic 2
VRI Implementation Planning
Tactic 1
Recreation Features Database Improvement
Tactic 1
Regional PEM Extension
Tactic 3
Regional Ecosystem Mapping
Tactic 2
PEM Model Research and Development
Tactic 1
Terrain Stability Mapping Research and Development
Tactic 1

Figure 2.1.1 **Design of the Forest Resources Inventory Knowledge Solution**

STRATEGY 1:VEGETATION RESOURCES INVENTORY

A Vegetation Resources Inventory (VRI) is a system for assessing the quantity and quality of timber, as well as other vegetation and features resources, including shrubs, herbs, woody debris, and soil condition. The VRI inventory system is implemented periodically within each forest management unit to establish or revise the status of the inventory. It incorporates remote sensing, field sampling and data analysis procedures that ensure an accurate, scientifically based estimate of each component of the inventory. VRI also yields resource data and information useful in other resource inventories and decision-support.

The recommended VRI regional knowledge strategy consists of 3 inter-related knowledge tactics:

Tactic 1: Management Unit VRI Planning

A Vegetation Resource Inventory is a complex and costly undertaking involving multiple agencies and organisations. VRI quality and efficiency depends on a high degree of co-operation between stakeholders in the management unit (forest districts within a TSA, TSA or TFL). A VRI tactical plan is a partnership agreement between government and forest licensee stakeholders specifying VRI requirements, priorities, completion goals and roles and responsibilities. VRI tactical plans document the operational schedule of VRI activity in the management unit over a five-year time frame, and are an essential planning guide for implementing a custom designed vegetation resources inventory.

The current status and perceived need for Vegetation Resources Inventories in all forest management units in the Omineca-Peace Region is reflected in Table 2.1.1 which presents a recommended schedule for VRI tactical planning investments over the next five years.

Table 2.1.1 VRI management unit planning investment recommendations

Management Unit	Forest District	Current Status	VRI Strategic Planning Implementation Schedule
P.G. TSA Blocks A, B, C	Fort St. James	VRI plan incomplete	2002/03[2]
Robson Valley TSA	Robson Valley	VRI plan incomplete	2002/03[3]
Dawson Creek TSA	Dawson Creek	new VRI plan required	2002/03[4]
P.G. TSA Blocks E, F, G	Prince George	new VRI plan required	2003/04[5]
Fort Nelson TSA	Fort Nelson	new VRI plan required	2005/06[6]

Immediate completion of an initial VRI tactical plan is recommended for the Prince George (Fort St. James Supply Blocks A, B, and C), Robson Valley TSA's, and is the highest investment priority.

VRI is a five-year iterative process, therefore revised tactical plans must also be completed for management units that have completed, or are completing their first Vegetation Resource Inventory. This is the case for the Dawson Creek and Prince George (Prince George Supply Blocks E, F and G) TSA's, and represents the next overall priority for completion.

Table 2.1.2 presents the current VRI status of the other six forest management units in the Omineca-Peace Region. These units will require completion of an initial or revised VRI tactical plan beyond the 2006/07 fiscal year.

Table 2.1.2 VRI Management Unit Planning Investment Recommendations – future needs

Management Unit	Forest District	Current Status
TFL 30 CANFOR-Prince George	Prince George	VRI completed.
TFL 48 CANFOR-Chetwynd	Dawson Creek	VRI completed.
Fort St. John TSA	Fort St. John	VRI plan completed, VRI Phase 1 completed.
P.G. TSA Block D	Vanderhoof	VRI plan completed, VRI Phase 1 completed.
Mackenzie TSA	Mackenzie	VRI plan completed, VRI Phase 1 underway.
TFL 53 DUNKLEY-Strathnaver	Prince George	no VRI plan – current inventory acceptable
TFL 42 TANIZUL-Fort St. James	Fort St. James	no VRI plan – current inventory acceptable

The estimated cost of completing a VRI tactical plan is approximately $15 000 to $20 000/management unit. Table 2.1.6 presents the cost schedule for these planning recommendations.

Tactic 2: Vegetation Resource Inventory Phase 1

A Vegetation Resources Inventory is implemented in two phases. In phase 1, boundaries and preliminary land cover attributes (characteristics) for vegetated and non-vegetated polygons are estimated through aerial photograph interpretation.

Phase 1 activities include aerial photo acquisition, polygon delineation at a scale of 1:15 000, estimation of compositional and structural polygon attributes, and preparation of a digital, polygon map with attribute text. Photo interpretation accuracy is ensured through air and ground calibration, but ground sampling of polygon attributes is not undertaken until Phase 2.

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[2] Fort St. James VRI plan should be completed by November, 2002.

[3] Robson Valley VRI plan should be completed by November, 2002.

[4] Dawson Creek VRI plan should be initiated November, 2002 and completed by March, 2003.

[5] Prince George VRI plan should be initiated November, 2003 and completed March, 2004.

[6] Fort Nelson VRI plan should be initiated November, 2005 and completed March, 2006.

Six criteria were evaluated to determine Phase 1 VRI investment priorities:

- scale of existing aerial photographic base;
- vintage of the inventory survey;
- proportion of timber harvest landbase to total forest area;
- level of current or proposed harvesting activity;
- stage of inventory database transition (higher priority for districts with a combination of VRI and older data); and
- expected schedule of future Timber Supply Reviews.

Table 2.1.3 presents the recommended management unit investment priorities, ranked by individual criteria, and by an overall, composite rank.

Table 2.1.3 Vegetation Resource Inventory Phase 1 Investment Recommendations

Overall Rank	**Forest Management Unit**	**Criteria**[7]					
		Scale of Photography	Age of Survey	Percent THLB	Operational Activity	Database Transition	TSR Schedule
1a[8]	Fort Nelson TSA	1	1	8	5	2	1
1b[9]	Fort St. John TSA	2	1	6	1	3	5
2[10]	P.G. TSA Vanderhoof (Supply Block D)	4	7	1	3	1	4
3a[11]	Mackenzie TSA	3	2	5	4	5	3
3b[12]	P.G. TSA (P.G. Supply Blocks E, F and G)	4	4	2	3	5	4
4[13]	P.G. TSA (Fort St. James Supply Blocks A, B and C)	4	5	3	2	5	4
5[14]	Dawson Creek TSA	4	3	4	4	4	6
6[15]	Robson Valley TSA	4	6	7	6	5	2

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[7] 1= highest priority; 8= lowest priority.

[8] Fort Nelson TSA VRI Phase 1 is underway, and should be completed in March, 2002.

[9] Fort St. John TSA VRI Phase 1 is underway, and should be completed in March, 2005.

[10] Prince George TSA (Vanderhoof Supply Block D) VRI Phase 1 has been completed.

[11] Mackenzie TSA VRI Phase 1 is underway, and should be completed in March, 2004.

[12] Prince George TSA (P.G. Supply Blocks A,B,C, E, F and G) should be initiated in 2003/04 and completed in March, 2007.

[13] P.G.TSA (Fort St. James Supply Blocks A, B and C) volume audits indicate no requirement for Phase 1 VRI activities.

[14] Dawson Creek TSA Phase 1 sampling has been completed.

[15] Robson Valley TSA Phase 1 needs will be determined pending completion of the VRI Tactical Plan.

It includes management units in the region for which Phase 1 VRI has either been completed, is currently underway, or is not anticipated before 2006/07.

The estimated cost and recommended schedule for completion of VRI Phase 1 activities is presented in Table 2.1.6, and is contingent on the scheduled completion of VRI tactical plans for each management unit.

Tactic 3: Vegetation Resource Inventory Phase 2

Completion of Phase 1 activities is followed by VRI Phase 2, consisting of ground sampling of the population of mapped polygons. A rigorous sampling design ensures unbiased and statistically valid attribute measurements. The relationship between the original estimates and these data are analysed, and becomes the basis for adjusting the original estimates across the population of polygons.

Phase 2 VRI activities include preparation of a ground sampling plan, plan implementation and collection of attribute data, data compilation, analysis and synthesis, associated net volume adjustment factor (NVAF) and within polygon (WPV) accuracy sampling, and Phase 1 Attribute and local growth model adjustments. Recommended VRI Phase 2 investment priorities are based on the following four criteria:

- relative variance between existing inventory data and results of a recent field inventory audit;
- significance of a problem forest type to local management issues;
- relative change in forest types associated with succession or disturbance since last survey; and
- relative complexity of local forest stands (multi-layer single species or species mixtures).

Table 2.1.4 presents the resulting forest district priority ranking by individual criteria, as well as an overall rank based on a blending of all the 4 criteria.

A detailed description of the estimated cost and recommended implementation schedule of Vegetation Resource Inventory Phase 2 activities is provided in Table 2.1.6. This schedule accounts for the availability or scheduled completion of VRI tactical plans for each management unit.

Because of individual management unit investment priorities, the complex interaction and sequencing of VRI activities, and recognition of the three additional strategies comprising this Resource Inventories knowledge solution, Table 2.1.6 includes a weighted "investment priority" rank for consideration by resource investment planners. The ranking rules used to assign priorities are presented at the end of this Issue section.

Table 2.1.4 **Vegetation Resource Inventory Phase 2 Forest District Priority Ranking**

Overall Rank	**Forest Management Unit**	**Criteria**[16]			
		Inventory Audit	Problem Type	Rate of Change	Stand Complexity
1a[17]	Fort Nelson TSA	1	2	3	3
1b[18]	Fort St. John TSA	2	1	3	3
2[19]	P.G. TSA (P.G. Supply Blocks E, F and G)	4	3	2	1

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[16] 1= highest priority; 8= lowest priority

[17] Phase 2 sampling plan is being prepared; activities should be initiated April 2002 and be completed March 2006.

[18] Phase 2 sampling in the Fort St. John TSA should begin April 2005, and be completed in March 2007.

[19] Phase 2 sampling for the existing P.G. TSA VRI (P.G. Supply Blocks E, F and G) should be completed March 2003.

3a[20]	P.G. TSA (Vanderhoof Supply Block D)	4	3	1	5
3b[21]	Mackenzie	3	2	4	4
4[22]	P.G. TSA (Fort St. James Supply Blocks A, B and C)			3	
5a[23]	Dawson Creek TSA	4	3	4	4
5b[24]	Robson Valley TSA	4	4	5	2

STRATEGY 2:RECREATION FEATURES INVENTORY

A recreation features inventory (RFI) identifies, classifies and records biophysical, cultural and historical landscape features for their recreational values. The RFI is one of four planning components making up the Recreation Resources Inventory (RRI), along with the recreation opportunities spectrum (ROS), Visual Resources inventory (VRI) and recreation facilities inventory. It provides information about recreation features to local land use planners and resource managers to assist them in making decisions on appropriate land use, resource development objectives and management prescriptions.

There is reason to suspect that the existing RFI for the Omineca-Peace Region (Prince George Forest Region) is either inaccurate or incomplete. It is known, for example, that detection of specific, subtle features such as caves and karsts, and general features in areas of limited access or sparse population have been inadequately identified during initial surveys.

The recommended knowledge strategy required to resolve this issue consists of a single tactic undertaken over three years.

Tactic 1: Recreational Features Database Improvement

This tactic consists of two, sequential investment activities undertaken over three years. It focuses on four specific areas of suspected inventory deficiency: Fort Nelson and Fort St. John forest districts adjacent to Muskwa-Kechika Park area; the Kechika-Gataga area of the Mackenzie forest district; and the Takla-Sustut area of the Fort St. James forest district. Extension of this tactic to the entire regional RFI should be considered at a later date. A more detailed schedule and cost estimate of these activities is presented in Table 2.1.6.

Activity 1: Gap Analysis and Inventory Tactical Planning

This investment initiative should be undertaken during the first year of the investment in order to evaluate the status of the existing inventory database in the four forest management units where major inadequacies are suspected, and to design an efficient means to remedy the problem. Specific tasks associated with this activity include:

- assembly of existing data and information;
- soliciting client and expert advice regarding local recreation features;
- identification of missed or poorly documented recreational features; and
- preparation of a remedial recreational features inventory tactical plan.

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[20] Phase 2 sampling for P.G. TSA (Vanderhoof Supply Block D) should begin April 2002 and be completed March 2004.

[21] Phase 2 sampling for the Mackenzie TSA should begin April 2004 and be completed March 2006.

[22] Phase 2 sampling for P.G. TSA (Fort St. James Supply Block D) should begin in 2002, and be completed March 2004.

[23] Limited Phase 2 sampling for Dawson Ck. TSA should begin in 2002 and be completed March, 2003.

[24] Phase 2 sampling needs will be determined for the Robson Valley TSA pending completion of the VRI Tactical Plan.

Activity 2: Recreational Features Remedial Inventory

Upon completion of the inventory tactical plan in Activity 1, remedial inventories should be initiated within the four selected management units during the second year of the three-year RFI strategy. Data collection and database revision should occur in the third year. Specific tasks associated with this activity include:

- collection of new or revise existing recreation features data;
- assembly the revised database and map base.

STRATEGY 3:ECOSYSTEM MAPPING

Ecosystem mapping results in stratification of a landscape into interpretive map units, according to a combination of ecological features, primarily climate, physiography, surficial material, bedrock geology, soil, and vegetation. Ecosystem mapping facilitates better sustainable forest management by providing:

- a biological and ecological framework for land management;
- a means of integrating abiotic and biotic ecosystem components on one map;
- basic information on the distribution of ecosystems for the purpose of broad landscape planning and site specific management interpretations;
- a basis for rating values of resources or indicating sensitivities in the landscape;
- an historic record of ecological site conditions that can be used as a framework for monitoring ecosystem response to management; and
- a planning tool for portraying ecosystem and landscape diversity.

Ecosystem mapping utilises an ecosystem classification framework to describe the nature, and pattern of ecological units; digital mapping technology is then used to depict the spatial distribution of ecological units across the landscape. The combined classification and mapping scheme is referred to as terrestrial ecosystem mapping (TEM).

Three levels of ecosystem integration are combined in TEM:

- regional ecosystems – the classification units are eco-sections, biogeoclimatic subzones and variants;
- local ecosystems – the classification units are site series; and
- vegetation structure and development – the classification units are structural stages and seral community types.

Terrestrial ecosystem maps depict three kinds of map units: eco-region map units, biogeoclimatic map units and ecosystem map units. Ecosystem units are conceptual groupings of similar site and vegetation development which are depicted as a single polygon

Predictive ecosystem mapping (PEM) is a new and evolving program designed to utilise available spatial data, knowledge of ecological-landscape relationships, and computer-based models to automate the generation of terrestrial ecosystem-type maps. PEM methods may be consistent with and complementary to traditional TEM procedures, and usually lower in overall cost. There are, however, tradeoffs between cost, resolution, and accuracy between the two mapping methods that must be considered when planning the intended use of the information. The PEM inventory systems, by their very nature, can provide a consistent treatment of available inventory data and knowledge, and offer the potential for increasing production rates and capacity.

The recommended knowledge strategy for resolving the need for a regional ecosystem inventory consists of three, staged tactics, each designed to advance the technology and use of predictive ecosystem mapping in the Omineca-Peace Region over the next five years. It is further recommended that a regional PEM Committee be appointed to co-ordinate implementation of all tactics and tasks associated with the strategy.

Tactic 1: PEM Model Research and Development

This tactic should be implemented via three, sequential PEM technology research and development projects designed to refine and improve the predictive capability of PEM models employed in the Omineca-Peace region:

Project 1: Technical Evaluation of Regional TEM/PEM Mapping Projects

This research and development project consists of a retrospective, technical evaluation of all TEM and PEM projects completed to date in the region, and should be completed during the first year of the Ecosystem Mapping strategy. The strengths and weaknesses of each mapping methodology, and their resulting accuracy and utility in specific regional applications should be evaluated and documented. This investment will serve as a mid-strategy, retrospective review of ecosystem mapping experience in the region. Component tasks should include:

- information assembly;
- client-user opinion surveys;
- map-to-field accuracy assessments; and
- evaluation reporting and recommendations.

Project 2: PEM Model Evaluation

An assessment of PEM models, in co-operation with the MoF Research Branch, is recommended for the first year of the Ecosystem Mapping strategy. This project will ensure that the most suitable ecosystem prediction models are selected for future use throughout the region. A range of TRIM-based PEM models should be assessed for their performance in predicting slope position/moisture regimes in representative Omineca-Peace ecosystems. Each model will be evaluated using suitability criteria, such as relative simplicity and predictive accuracy, and the results documented. This initiative will facilitate better, local selection of existing PEM model design, as well as provide re-design or modification recommendations. Specific tasks associated with this project include:

- information assembly;
- test area selection;
- local refinement of each model;
- accuracy evaluation using common data sets;
- comparison of results with conventional methods (terrain, bioterrain and VRI maps); and
- reporting and recommendations

Project 3: PEM Model Data Input Evaluation

An assessment should be undertaken to evaluate, in a step-wise analysis, the cumulative predictive value of various data input layers (e.g. forest cover, classified satellite images and others) to the accuracy of PEM model prediction. This research and development project is designed to test the relationship between the optimum number and type of data input layers and the characteristics of the vegetation and terrain the model is applied to. The evaluation should therefore encompass a range of distinctly different ecosystems. Specific tasks associated with this initiative include:

- selection of test areas;
- assembly of data input layers for evaluation;
- localisation and refinement of PEM models to be tested;
- comparison of predictions with actual ecosystem units; and
- reporting and recommendations.

Tactic 2: Regional Ecosystem Mapping

Completion of ecosystem mapping throughout the Omineca-Peace region should be undertaken upon completion of the three research and development investment activities of Tactic 1, and incorporation of their recommendations for improvement into regional PEM technology. This subsequent tactic requires, firstly, a tactical planning investment in order to ensure optimum investment efficiency of the second, more costly investment.

Project 1: Regional Ecosystem Mapping Tactical Planning

Ecosystem mapping is an important, though costly initiative. Preparation of a comprehensive, co-ordinated implementation plan is essential to guarantee technical quality, timely completion, investment efficiency, and ultimately, user satisfaction. Design of a regional PEM implementation plan by an ad hoc regional implementation committee (to be appointed for the purpose) is therefore recommended. This plan should be developed early in the second year of the Ecosystem Mapping strategy. Specific tasks assigned to the committee should include:

- preparation of a status report identifying of all currently mapped areas in the region;
- construction of a regional PEM project ranking scheme;
- development of a regional implementation schedule and refined budget; and
- design or re-design of mapping standards incorporating evaluation results and recommendations from previously completed research and development activities.

Activity 2: Regional Ecosystem Mapping

Operational implementation should begin during the second year, upon completion of the PEM implementation plan. Implementation should be completed within three years. Full implementation of this knowledge investment will facilitate all other regional knowledge strategies that rely on spatially explicit, ecological information.

Tactic 3: Regional PEM Extension

This investment initiative is highly recommended as a means of advancing the use of the technology by regional forest resource planners. A regional stakeholder and PEM user's workshop should be hosted during the second year of the Ecosystem Mapping strategy. This workshop should bring PEM developers and experts together with SFM practitioners and other potential PEM clients to demonstrate advances and applications of the technology.

A more detailed schedule and cost estimate of these activities is presented in Table 2.1.6.

STRATEGY 4:TERRAIN STABILITY INVENTORY

An inventory of terrain stability involves the classification and mapping of terrain sensitivity based on inherent, physical stability. The purpose of terrain stability mapping is to identify unstable terrain and areas of existing or potential landslides, and to assign an estimated probability (hazard) or risk of future terrain failure.

The most common uses of terrain stability mapping is resource development planning, land use and development planning; and for planning of specific engineered structures such as roads, railways, pipelines, and transmission lines. Potential SFM uses include:

- designing cutblock boundaries, forest road alignments, and timber harvesting systems, that minimise future landslides;
- predicting the location and potential for terrain failure, and their expected severity, resulting from road construction, or harvesting disturbance;
- designing road deactivation plans; and
- selecting suitable locations for forestry camps, mill sites and other habitation facilities.

Three levels of terrain stability classification are used in the Omineca-Peace Region:

- Reconnaissance Terrain Stability Mapping - identifies unstable or potentially unstable terrain from a broad, landscape perspective;
- Detailed Terrain Stability Mapping - a comprehensive assessment of terrain stability within a specific forest development area; and
- Field Terrain Stability Assessments – detailed assessment of specific areas of terrain related to concerns about cutting permit or road construction disturbance.

Terrain stability mapping is based partly on scientific principles and partly on the intuition and experience of the mapper. It has been implemented at all three levels in portions of all forest districts during the past two decades, but much more frequently and at larger scales after 1994. The rapid expansion of terrain stability mapping since 1994 has produced map work of uncertain quality; not all mapping is expected to comply with present day standards of accuracy.

In some cases, mapping has been conducted where, due to low hazard or risk, it was not warranted. In other cases the classification of terrain was too conservative, or the resolution of mapping was too broad to accurately identify actual hazard (i.e. areas with only minor proportions of unstable terrain were included in high hazard map units made up of largely stable terrain).

Such "over-classification" has resulted in unnecessary and costly field terrain stability assessments and unwarranted timber supply constraint implications. The regional terrain stability mapping strategy therefore consists of a three-year review of completed terrain stability mapping projects in all forest districts.

The following knowledge strategy is recommended to address these problems. It should be implemented via a single investment tactic, undertaken over three years:

Tactic 1: Terrain Stability Mapping Research and Development

This tactic consists of three sequential investment initiatives:

Project 1: Retrospective Evaluation of Regional Terrain Stability Mapping

During the first year of the TSM Inventory strategy a retrospective review of the status and quality of all previous Omineca-Peace regional terrain stability mapping projects should be undertaken. The purpose of this investment is to identify the stage of completion, and interpretative quality of all previous terrain stability mapping works, and to recommend steps to improve deficient methodology or standards of classification.

Project 2: Pilot Study of Terrain Stability Mapping Risk Analysis

Upon completion of Project 1, a research and development investment should be undertaken in the Fort Nelson and Fort St. John TSA's. The purpose of this operational scale, pilot study is to develop a risk-ranking scheme suitable for identifying high priority TSM mapping needs. Specific tasks associated with the investment activity should include:

- information assembly;
- development of a risk analysis ranking scheme;
- completion of risk assessment field surveys throughout both pilot districts; and
- design of a priority mapping strategy for both districts.

Project 3: Pilot Study of High Priority TSM Mapping

Upon completion of Project 2, a second pilot study is recommended to evaluate the success of subsequent mapping of high priority, unstable terrain in both forest management units. The relative success and efficiencies of both studies will determine any subsequent implementation of the procedures elsewhere in the Omineca-Peace region.

A detailed schedule and cost estimate of these activities is presented in Table 2.1.6.

Table 2.1.6 Resource Inventory Knowledge Solution Summary Table

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. VEGETATION RESOURCES INVENTORY	1) VRI STRATEGIC PLANNING	Fort St. James	4	15000	15000				
		Robson Valley	4	15000	15000				
		Dawson Creek	4	15000	15000				
		Prince George	10	15000		15000			
	2) VRI PHASE 1 INVENTORY	Fort Nelson	22	20000				20000	
		Mackenzie	5	2912000	[illegible]	[illegible]			
		Fort St John	5	3000000	[illegible]	[illegible]	[illegible]		
		Prince George	11	2710000		[illegible]	[illegible]	[illegible]	[illegible]
		Dawson Creek	11	750000		750000			
	3) VRI PHASE 2 INVENTORY	i) Sample Plan Preparation Fort Nelson	1	15000	15000				
		Vanderhoof	1	15000	15000				
		Mackenzie	9	15000		15000			
		ii) Data Collection Fort St. James	1	500000	500000				
		Prince George	1	100000	100000				
		Vanderhoof	2	200000	200000				
		Fort Nelson	2	775000	[illegible]	[illegible]			
		Mackenzie	16	312000			312000		
		TFL 48	2	235000	[illegible]	[illegible]			
		Fort St. John	20	500000				500000	
		iii) Data Analysis Fort St. James	2	10000	10000				
		Fort Nelson	3	25000	[illegible]	[illegible]			
		Vanderhoof	3	15000	15000				
		Fort St. John	21	10000				10000	
		iv) NVAF Sampling Dawson Creek	1	29000	29000				
		Vanderhoof	4	85000	85000				
		Prince George	1	110000	110000				
		Fort St. James	3	80000		80000			
		TFL 48	3	75080	75000				
		Mackenzie	17	85000			85000		
		Fort Nelson	16	160000			160000		
		Fort St. John	23	130000					130000
		v) WPV Sampling Vanderhoof	9	300000		300000			
		TFL 48	18	75000			75000		
		Fort Nelson	20	120000				120000	
		Mackenzie	20	217500				217500	
Recommended Vegetation Resources Inventory Strategic Knowledge Investments				**$13645500**	**[illegible]**	**[illegible]**	**2382000**	**1617500**	**[illegible]**
2. RECREATION FEATURES INVENTORY	1) RFI DATABASE IMPROVEMENT	i) Gap Analysis and Tact. Planning Fort Nelson		12500	12500				
		Mackenzie	6	12500	12500				
		Fort St. John	6	12500	12500				
		Fort St. James	6	12500	12500				
		ii) Recreational Features Invent. Fort Nelson	12	100000		62500	37500		
		Mackenzie	12	10[illegible]		62500	37500		
		Fort St. John	12	100000		62500	37500		
		Fort St. James	12	100000		62500	37500		
Recommended Recreation Features Inventory Strategic Knowledge Investments				**$450000**	**50000**	**250000**	**150000**	**0**	**0**

3. ECOSYSTEM MAPPING	1) TEMPEM RESEARCH AND DEVELOPMENT	i) TEM/PEM Project Evaluation	7	10000	10000				
		ii) PEM Model Evaluation	7	100000	100000				
		iii) PEM Data Input Evaluation	7	500000	500000				
	2) REGIONAL ECOSYSTEM MAPPING	i) Regional PEM Tactical Planning	13	5000		5000			
		ii) Regional Ecosystem Mapping Implementation	14	1600000		[illegible]	[illegible]	[illegible]	
	3) REGIONAL PEM EXTENSION	iii) Regional PEM Users Workshops	18	50000			50000		
Recommended Ecosystem Mapping Strategic Knowledge Investments				**$2265000**	**610000**	**605000**	**550000**	**500000**	**0**
4. TERRAIN STABILITY INVENTORY	1) TERRAIN STABILITY MAPPING IMPROVEMENT	i) TSM Quality Evaluation and Reporting	8	100000	100000				
	2) IMPROVING SPECIES KNOWLEDGE FOR THE	ii) Risk Analysis Pilot Evaluation	15	200000		200000			
	3) IMPROVING SPECIES KNOWLEDGE FOR THE LONG-	iii) Completion of Priority Mapping	19	300000			300000		
Recommended Strategy 4 Knowledge Investments				**$600000**	**100000**	**200000**	**300000**	**0**	**0**
Total Recommended Species-at-Risk Knowledge Solution Investment				**$5790000**	**[illegible]**	**[illegible]**	**[illegible]**	**0**	**0**

Resource Inventories Strategic Investment Priority Scheme
There is great complexity and interaction between ranking criteria of the four inventories. In an attempt to consolidate these into an overall, investment, ranking scheme, the following investment priority "rules" were applied to the recommendations received from the Tactical Planning Team. During any investment year, the order of investment priority is:

- implementation of the Vegetation Resources Inventory strategy; followed by
- implementation of the Recreation Features Inventory strategy; followed by
- implementation of the Ecosystem Inventory strategy; followed by
- implementation of the Terrain Stability Inventory strategy.

Within each knowledge strategy, tactics (or activities, or projects within a tactic) are implemented in their sequential order of description in Table 2.1.6, which reflects either their perceived priority in the region, or the logical investment sequence in the implementation of the strategy.

During any fiscal year, implementation, or partial implementation of all four strategies is preferred over implementation of the highest priority strategy remaining to be implemented.

Once a multi-year activity within a given tactic has been initiated, completion in subsequent years has priority over implementation of another activity within the same tactic, within the same strategy or from another strategy.

Where resource investment funds are limiting during any year, activities should be funded in the order specified by "Investment Priority Ranking" in Table 2.1.6; un-funded activities should be re-scheduled to the next fiscal year. This will necessarily lengthen the duration of each strategy, but the overall investment priority and logical investment sequence will remain consistent with the recommendations for resolving this issue.

Table 2.1.6 Resource Inventory Knowledge Solution Summary Table

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. VEGETATION RESOURCES INVENTORY	1) VRI STRATEGIC PLANNING	Fort St. James	4	15000	▨				
		Robson Valley	4	15000	▨				
		Dawson Creek	4	15000	▨				
		Prince George	10	15000		▨			
	2) VRI PHASE 1 INVENTORY	Fort Nelson	22	20000				▨	
		Mackenzie	5	2912000	▨	▨			
		Fort St. John	5	3000000	▨	▨	▨		
		Prince George	11	2710000		▨	▨	▨	▨
		Dawson Creek	11	750000		▨			
	3) VRI PHASE 2 INVENTORY	i) Sample Plan Preparation Fort Nelson	1	15000	▨				
		Vanderhoof	1	15000	▨				
		Mackenzie	9	15000		▨			
		ii) Data Collection Fort St. James	1	500000	▨				
		Prince George	1	100000	▨				
		Vanderhoof	2	200000	▨				
		Fort Nelson	2	775000	▨	▨			
		Mackenzie	16	312000			▨		
		TFL 48	2	235000	▨	▨			
		Fort St. John	20	500000				▨	
		iii) Data Analysis Fort St. James	2	10000	▨				
		Fort Nelson	3	25000	▨	▨			
		Vanderhoof	3	15000	▨				
		Fort St. John	21	10000				▨	
		iv) NVAF Sampling Dawson Creek	1	29000	▨				
		Vanderhoof	4	85000	▨				
		Prince George	1	110000	▨				
		Fort St. James	3	80000		▨			
		TFL 48	3	75000	▨				
		Mackenzie	17	85000			▨		
		Fort Nelson	16	160000			▨		
		Fort St. John	23	130000					▨
		v) WPV Sampling Vanderhoof	9	300000		▨			
		TFL 48	16	75000			▨		
		Fort Nelson	20	120000				▨	
		Mackenzie	20	217500				▨	
Recommended Vegetation Resources Inventory Strategic Knowledge Investments				**$13645500**	4831000	3935000	2382000	1617500	880000
2. RECREATION FEATURES INVENTORY	1) RFI DATABASE IMPROVEMENT	i) Gap Analysis and Tact. Planning Fort Nelson		12500	▨				
		Mackenzie	6	12500	▨				
		Fort St. John	6	12500	▨				
		Fort St. James	6	12500	▨				
		ii) Recreational Features Invent. Fort Nelson	12	100000		▨	▨		
		Mackenzie	12	100000		▨	▨		
		Fort St. John	12	100000		▨	▨		
		Fort St. James	12	100000		▨	▨		
Recommended Recreation Features Inventory Strategic Knowledge Investments				**$450000**	50000	250000	150000	0	0

3. ECOSYSTEM MAPPING	1) TEM/PEM RESEARCH AND DEVELOPMENT	i) TEM/PEM Project Evaluation	7	10000	▨				
		ii) PEM Model Evaluation	7	100000	▨				
		iii) PEM Data Input Evaluation	7	500000	▨				
	2) REGIONAL ECOSYSTEM MAPPING	i) Regional PEM Tactical Planning	13	5000		▨			
		ii) Regional Ecosystem Mapping Implementation	14	1600000		▨	▨	▨	
	3) REGIONAL PEM EXTENSION	iii) Regional PEM Users Workshops	18	50000			▨		
Recommended Ecosystem Mapping Strategic Knowledge Investments				**$2265000**	610000	605000	550000	500000	0
4. TERRAIN STABILITY INVENTORY	1) TERRAIN STABILITY MAPPING IMPROVEMENT	i) TSM Quality Evaluation and Reporting	8	100000	▨				
	2) IMPROVING SPECIES KNOWLEDGE FOR THE	ii) Risk Analysis Pilot Evaluation	15	200000		▨			
	3) IMPROVING SPECIES KNOWLEDGE FOR THE LONG-	iii) Completion of Priority Mapping	19	300000			▨		
Recommended Strategy 4 Knowledge Investments				**$600000**	100000	200000	300000	0	0
Total Recommended Species-at-Risk Knowledge Solution Investment				**$5790000**	200000	[illegible]	[illegible]	0	0

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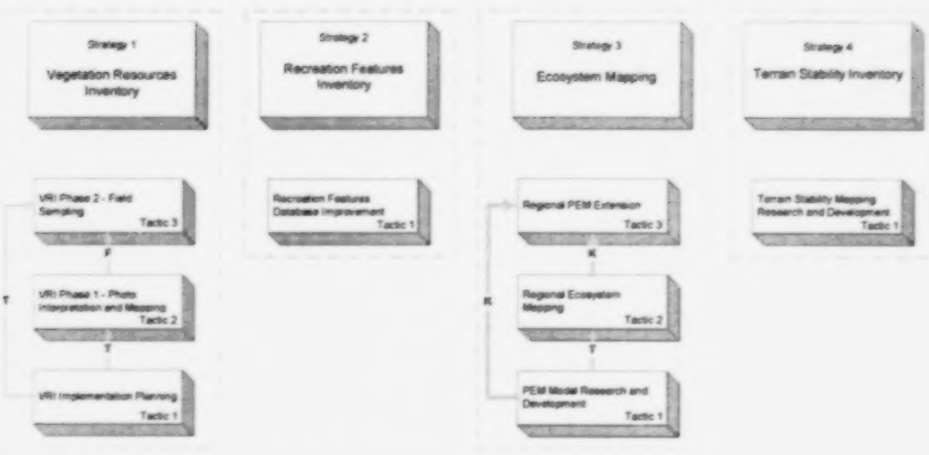
Strategy 1
Vegetation Resources Inventory
Strategy 2
Recreation Features Inventory
Strategy 3
Ecosystem Mapping
Strategy 4
Terrain Stability Inventory
VRI Phase 2 - Field Sampling
Tactic 3
F
VRI Phase 1 - Photo Interpretation and Mapping
Tactic 2
T
T
VRI Implementation Planning
Tactic 1
Recreation Features Database Improvement
Tactic 1
Regional PEM Extension
Tactic 3
K
K
Regional Ecosystem Mapping
Tactic 2
T
PEM Model Research and Development
Tactic 1
Terrain Stability Mapping Research and Development
Tactic 1

Figure 2.1.2 **Interactions and Linkages within the Forest Resources Inventories Knowledge Solution**

Figure 2.1.2 depicts some of the obvious interactions and linkages within the strategies making up the Resource Inventories Knowledge Solution.

VRI Strategy

Tactic 1 is a key investment requirement since it provides technical direction to both subsequent investment tactics (phase 1 and phase 2 sampling). Tactic 1 is functionally linked to Tactic 2 due the required order of inventory procedures.

Ecosystem Mapping Strategy

Implementation of ecosystem mapping throughout high priority areas of the region cannot be initiated without first completing the PEM model research and development initiatives in Tactic 1. Tactic 1 provides the necessary technical direction required for cost effective, accurate mapping. Tactic 1 and 2 produce the knowledge required for Tactic 3 (PEM Extension). Knowledge gained from Tactic 2 flows to all other knowledge solutions that require a land base ecosystem framework.

ISSUE 2 INCOMPLETE CARIBOU MANAGEMENT OBJECTIVES

Caribou are listed nationally as a "threatened" species. This knowledge issue is addressed separately from other at-risk species (section 2.3) due to greater public awareness of the species; caribou are highly valued by public. Despite this greater recognition, autecological and synecological knowledge of caribou is insufficient to ensure their sustainable management in the Omineca-Peace Region. Forest development influences the behaviour, health and likelihood of survival of individual animals, as well as the distribution, abundance and vigour of caribou populations. An incomplete understanding of the interactions between caribou and forest harvesting operations increases their risk of exclusion from specific habitats, and decline of herd size.

RECOMMENDED CARIBOU MANAGEMENT KNOWLEDGE SOLUTION

As depicted in Figure 2.2.1, three, key knowledge strategies are recommended as the knowledge solution. They will greatly reduce uncertainty in caribou management, and substantially improve the ability to predict caribou response to forest practices. A full, technical description of the strategies is found in Section 3.

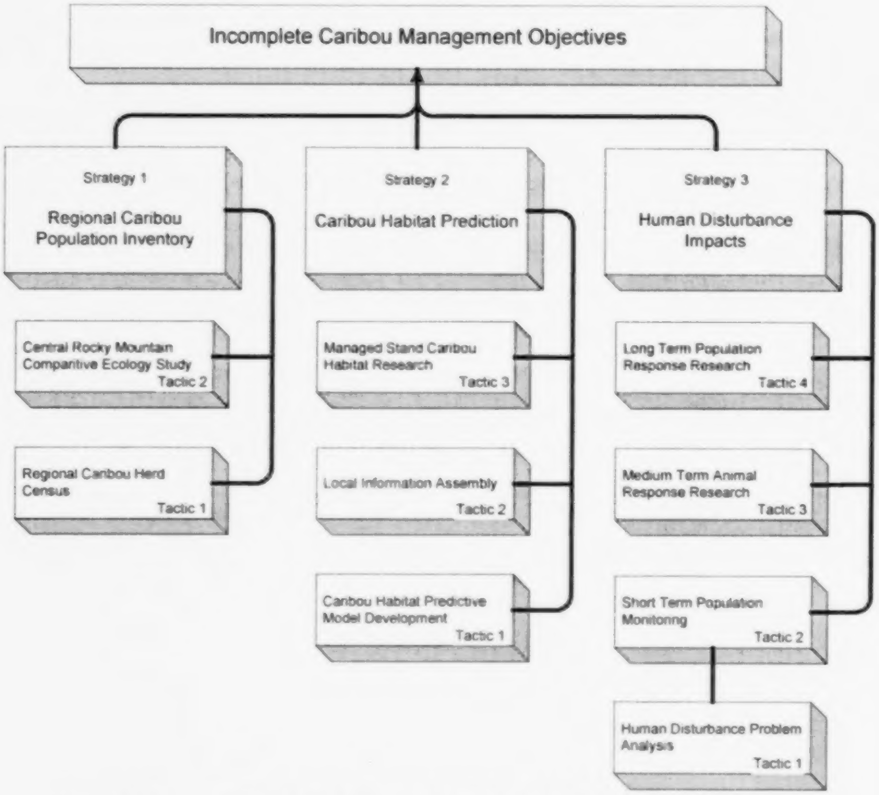
Incomplete Caribou Management Objectives
Strategy 1
Regional Caribou Population Inventory
Strategy 2
Caribou Habitat Prediction
Strategy 3
Human Disturbance Impacts
Central Rocky Mountain Comparitive Ecology Study
Tactic 2
Regional Caribou Herd Census
Tactic 1
Managed Stand Caribou Habitat Research
Tactic 3
Local Information Assembly
Tactic 2
Caribou Habitat Predictive Model Development
Tactic 1
Long Term Population Response Research
Tactic 4
Medium Term Animal Response Research
Tactic 3
Short Term Population Monitoring
Tactic 2
Human Disturbance Problem Analysis
Tactic 1

Figure 2.2.1 **Design of the Caribou Knowledge Solution**

STRATEGY 1.REGIONAL CARIBOU POPULATION INVENTORY STRATEGY

The size and population dynamics of all caribou herds in the Omineca Peace region are not currently known with certainty. While crude estimates are available for a few herds, including those of the southern Mackenzie and Fort St. James forest districts, the Entiako herd, and some mountain caribou herds, little is known of Peace River and more northerly herds.

Knowledge of the ecology of woodland caribou herds in the central Rocky Mountains is especially lacking. This geographic area is a transition zone between two distinct ecotypes of woodland caribou: the mountain caribou ecotype, which feed primarily on arboreal lichens; and northern caribou ecotype, which feed primarily on terrestrial lichens. Understanding this key ecological distinction is an important pre-requisite to correctly interpreting regional caribou population information in SFM decisions.

This knowledge strategy is designed to confirm the habitat selection and life cycle ecology for herds within the central Rocky Mountains, and to reinforce on-going herd survey initiatives. The strategic goal is to complete, as soon as possible, the regional caribou population census in order to facilitate improved caribou management decision-making. Two, complementary, knowledge tactics are recommended to implement this strategy:

Tactic 1: Regional Caribou Herd Census

Winter herd surveys are underway in the Omineca-Peace region, yet acceleration of this tactic is required if forest managers are to successfully address the "threatened population" status of the species. A key pre-requisite of this tactic is re-design of census techniques and sampling designs in order to improve the reliability of population estimates.

Tactic 2: Central Rocky Mountain Comparative Ecology Research

The ecological requirements of the caribou population of the Central Rocky Mountain transitional area must be distinguished in order to facilitate meaningful management interpretations. The design of appropriate silvicultural systems for maintenance or creation of caribou habitat depends on knowledge of specific foraging behaviour. For example, uneven age management and partial cutting are recommended to provide the arboreal food source for mountain caribou, however northern caribou require even-age management, clearcutting and large patch size to promote terrestrial lichen production.

A single, five year research and development initiative is recommended as the best means to acquire the necessary habitat ecology knowledge. This activity should be initiated in the first year of the Regional Caribou Population Census strategy to ensure timely forest management interpretations.

Table 2.2.1 presents a detailed estimate of the costs associated with implementing strategy 2.

STRATEGY 2.CARIBOU HABITAT PREDICTION STRATEGY

Achievement of forest management unit LRMP objectives for the sustainable management of caribou and their habitat is constrained due to:

- inadequate population inventory and habitat use information;
- incomplete knowledge of the response of key habitat features to forest management practices; and
- lack of a mechanism to employ information and knowledge to support decisions.

For example, while limited data and information on habitat use exist for a few geographic areas in the region, it is inadequate to account for seasonal use variation between areas. Also, forest practices impact on lichen ecology is poorly understood, and better knowledge of ecosystem specific, terrestrial and arboreal lichen yield responses to a wide range of timber harvesting systems is required. The problem is further confounded by lack of a biologically realistic projection model with which to predict the dynamics, future state and potential suitability of caribou habitat in response to a variety of hypothetical forest management scenarios.

This issue is addressable in the short term by a knowledge strategy employing three component tactics. A suitable pilot model of the recommended strategy is provided by an existing program of stakeholder research of northern caribou in the Mackenzie Forest District. This project has been designed to incorporate localised population and habitat use data and information with local ecological knowledge of stand and forest dynamics, to produce a caribou habitat supply model capable of realistic habitat supply predictions based on local forest management scenarios. This strategy is advocated throughout their range in the Omineca-Peace Region.

Tactic 1: Caribou Habitat Supply Model Development

Tactic 1 utilises data, information and knowledge assembled in Tactic 2, and integrates new habitat response knowledge captured in Tactic 3. While the structure of the resulting predictive model may vary, depending on ecological conditions and model developer, the basic design of the supply model should incorporate adaptive management principles and provide local forest managers a realistic, locally calibrated decision support tool.

Tactic 2: Local Information Assembly

This tactic is intended to consolidate and document all (known and future) caribou inventory (population state, dynamics), autecological (local animal and herd characteristics and behaviour) and synecological (animal and herd ecological interactions, habitat requirements and selection) and information. Co-ordination with the Regional Caribou Population Inventory Strategy is recommended in order to optimise the investment in new inventory data. The overarching objective of Tactic 2 is not the assembly of information and knowledge itself, but in support of development of local decision-support prediction models described in Tactic 1.

Tactic 3: Managed Stand Caribou Habitat Research

This research and development tactic is recommended to improve knowledge of the impacts of silvicultural practices on key habitat features. Lichen yield response to forest management dynamics is currently the highest priority investment of this type for caribou management.

Two local research projects underway in Mackenzie and Vanderhoof provide an effective tactical implementation model. On completion, they will yield a better understanding of the key ecological factors that influence the distribution, abundance, retention and vigour of both lichen species. Expansion of this tactic to as yet unrepresented ecosystems is recommended in order to reflect a wider range of lichen response throughout the region. This will increase stand level knowledge of forest floor and canopy lichen dynamics and improve local silvicultural decisions aimed at enhancing lichen production and caribou habitat capability.

This investment tactic is designed to directly support the development of local prediction models described in Tactic 1.

Table 2.2.1 presents a detailed estimate of the costs associated with strategy 2 recommendations.

STRATEGY 3.HUMAN DISTURBANCE IMPACTS RESEARCH STRATEGY

Increased human activity in the backcountry has resulted in concerns about direct and indirect effects on caribou and their habitat use. Recreation activities such as snowmobiling and helicopter use, relative to other backcountry activities, afford the greatest threat to caribou because of their potential effects in critical, high elevation habitat.

The impacts to caribou from snowmobile or helicopter activity are not well understood; the scientific literature and knowledge base is limited. In particular, no information exists concerning caribou range abandonment or population dynamics consequences of human activity. Overall, snowmobile use is believed to pose the greatest threat. Snowmobile use in late winter caribou foraging habitat interferes with habitat use, and increases predator access. These impacts to caribou may lead to reduced forage intake, increased energy expenditure and general physical decline. Disturbance of this type threatens to displace caribou herds from critical range in the short term, and could result in medium and long term population losses.

Four, integrated tactics are recommended as a means of implementing this knowledge strategy over the next five years. All are research and development investments focused on northern and mountain caribou habitats across the entire Omineca-Peace Region. They are designed to provide a better understanding of the nature of the interaction between caribou habitat and disturbance, with the goal of supporting SFM decisions for the control of adverse caribou population impacts.

Tactic 1: Human Disturbance Problem Analysis

The limited status of knowledge concerning human disturbance impacts requires that a problem analysis be undertaken. This tactic is will specify the design of an integrated research and development program which addresses three time and spatial scales. This tactic comprises two distinct activities, although they may be undertaken together depending on opportunity and efficiency.

Project 1:Northern Caribou/Human Disturbance Literature Review

This investment activity is required to assemble all pertinent information and knowledge on the issue. A key outcome will be a clear statement of the actual problem, and recommendations on the research options capable of resolving the knowledge gap. This tactic may also yield interim SFM guidelines until research initiatives are completed.

Project 2: Research Plan and Program Development

This activity is an essential pre-requisite to an efficient, and integrated research program aimed at filling the knowledge gap(s) identified in *Activity 1*. It is anticipated that research at three levels of space/time may be required, each with its own research plan, yet designed to efficiently complement an overall, integrated research program.

Tactic 2: Short Term Population Monitoring

This knowledge tactic is recommended as an expedient means of addressing short term, acute caribou behavioural response through modest expansion of the Regional Caribou Population Census Strategy. Design and sampling details will be determined in Tactic 1.

Tactic 3: Medium-Term Animal Response Research

This knowledge tactic consists of a longer term and more intensive research and monitoring initiative addressing chronic behavioural responses to disturbance. Design and sampling details will be determined in Tactic 1.

Tactic 4: Long-Term Population Response Research

This tactic is expected to enhance knowledge of potential caribou population changes resulting from longer-term habitat disturbance. Design and sampling details will be determined in Tactic 1.

Table 2.2.1 presents a detailed estimate of the costs for all tactics recommended in strategy 3.

Table 2.2.1 **Caribou Management Objectives Knowledge Solution Summary Table**

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. REGIONAL CARIBOU POPULATION INVENTORY	1) REGIONAL CARIBOU HERD CENSUS		1	300000300,000	60000	60000	60000	60000	60000
	2) CENTRAL ROCKY MOUNTAINS COMPARITIVE ECOLOGY PROJECT		1	1000000	200000	200000	200000	200000	200000
Recommended Regional Caribou Population Inventory Strategic Knowledge Investments				**$1300000**	**260000**	**260000**	**260000**	**260000**	**260000**
2. CARIBOU HABITAT SUPPLY MODELLING	1) CARIBOU HABITAT SUPPLY MODEL DEVELOPMENT		2	4750000	950000	950000	950000	950000	950000
	2) LOCAL INFORMATION ASSEMBLY		2	250000	50000	50000	50000	50000	50000
	3) MANAGED STAND HABITAT RESEARCH		2	900000	200000	200000	200000	150000	150000
Recommended Caribou Habitat Prediction Strategic Knowledge Investments				**$5900000**	**1200000**	**1200000**	**1200000**	**1150000**	**1150000**
3. HUMAN DISTURBANCE IMPACTS RESEARCH	1) HUMAN DISTURBANCE PROBLEM ANALYSIS	i) Human Disturbance Literature Review	3	20000	20000	0	0	0	0
		ii) Research Plan and Program Development	4	5000	5000	0	0	0	0
	2) SHORT TERM POPULATION MONITORING		5	105000	25000	20000	20000	20000	20000
	3) MEDIUM TERM ANIMAL RESPONSE RESEARCH		5	185000	25000	40000	40000	40000	40000
	4) LONG TERM POPULATION RESPONSE RESEARCH		5	185000	25000	40000	40000	40000	40000
Recommended Human Disturbance Impacts Research Strategic Knowledge Investments				**$500000**	**100000**	**100000**	**100000**	**100000**	**100000**
Total Recommended Caribou Management Knowledge Solution Investment				**$1000000**	**200000**	**200000**	**200000**	**200000**	**200000**

Figure 2.2.2 depicts some of the obvious interactions and linkages within and between the three strategies making up the Caribou Management Knowledge Solution.

Regional Caribou Population Inventory Strategy
Tactic 2 provides technical support to Tactic 1 (population census), which yields local knowledge required in Tactic 2 of the Caribou Supply Modelling Strategy.

Caribou Habitat Supply Modelling Strategy
There is a Technical linkage between Tactic 3 and Tactic 1 (Caribou Habitat Supply Model Development) as well as a technical linkage between Tactic 2 (Local Knowledge) and Tactic 1. Knowledge produced in Tactic 3 is assembled in Tactic 2, as is knowledge produced in three of the tactics of the Human Disturbance Impacts Strategy.

Human Disturbance Impacts Strategy
Tactic 1 (Problem Analysis) is the key, initial investment, and provides technical direction to Tactics 2 to 4.

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Table 2.2.1 **Caribou Management Objectives Knowledge Solution Summary Table**

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
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1. REGIONAL CARIBOU POPULATION INVENTORY	1) REGIONAL CARIBOU HERD CENSUS		1	300000300 000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	2) CENTRAL ROCKY MOUNTAINS COMPARITIVE ECOLOGY PROJECT		1	1000000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Recommended Regional Caribou Population Inventory Strategic Knowledge Investments				**$1300000**	**260000**	**260000**	**260000**	**260000**	**260000**
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	2) LOCAL INFORMATION ASSEMBLY		2	250000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	3) MANAGED STAND HABITAT RESEARCH		2	900000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Recommended Caribou Habitat Prediction Strategic Knowledge Investments				**$5900000**	**1200000**	**1200000**	**1200000**	**1150000**	**1150000**
3. HUMAN DISTURBANCE IMPACTS RESEARCH	1) HUMAN DISTURBANCE PROBLEM ANALYSIS	i) Human Disturbance Literature Review	3	20000	[illegible]	0	0	0	0
		ii) Research Plan and Program Development	4	5000	[illegible]	0	0	0	0
	2) SHORT TERM POPULATION MONITORING		5	105000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	3) MEDIUM TERM ANIMAL RESPONSE RESEARCH		5	185000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	4) LONG TERM POPULATION RESPONSE RESEARCH		5	185000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Recommended Human Disturbance Impacts Research Strategic Knowledge Investments				**$500000**	**100000**	**100000**	**100000**	**100000**	**100000**
Total Recommended Caribou Management Knowledge Solution Investment				**$1000000**	**200000**	**200000**	**200000**	**200000**	**200000**

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Human Disturbance Impacts Strategy
Tactic 1 (Problem Analysis) is the key, initial investment, and provides technical direction to Tactics 2 to 4.

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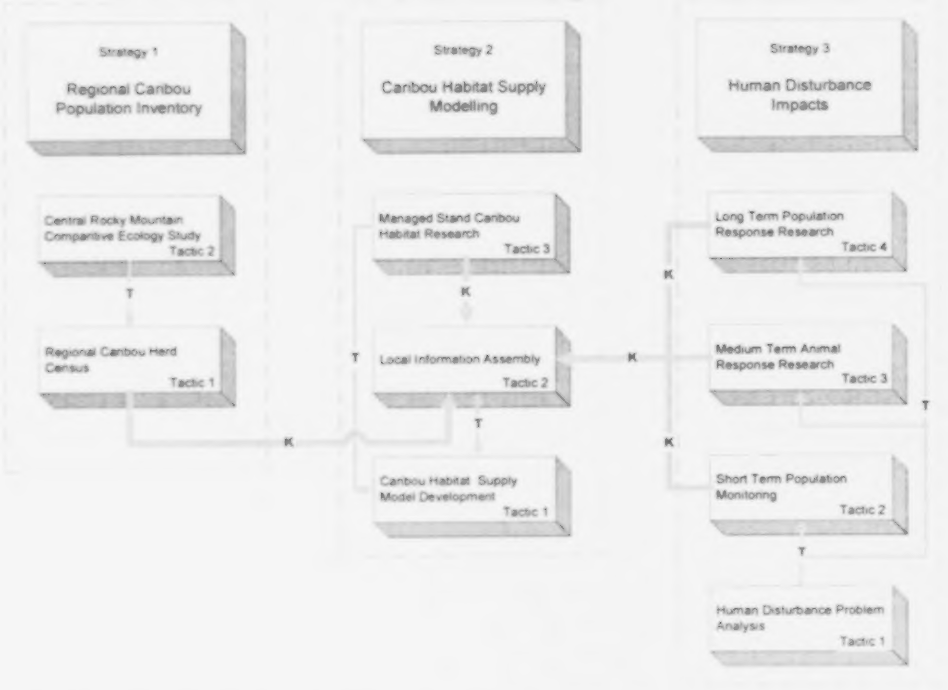
Strategy 1
Regional Caribou Population Inventory
Strategy 2
Caribou Habitat Supply Modelling
Strategy 3
Human Disturbance Impacts
Central Rocky Mountain Comparitive Ecology Study
Tactic 2
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Regional Caribou Herd Census
Tactic 1
Managed Stand Caribou Habitat Research
Tactic 3
K
T
Local Information Assembly
Tactic 2
T
K
Caribou Habitat Supply Model Development
Tactic 1
Long Term Population Response Research
Tactic 4
K
K
Medium Term Animal Response Research
Tactic 3
T
K
Short Term Population Monitoring
Tactic 2
T
Human Disturbance Problem Analysis
Tactic 1

Figure 2.2.2. **Interactions and Linkages within the Caribou Management Knowledge Solution.**

ISSUE 3 LACK OF SPECIES-AT-RISK MANAGEMENT OBJECTIVES

Grizzly bear, wolverine, fisher, arctic grayling, bull trout, white sturgeon and various raptor and songbird populations, and the availability and integrity of their habitat, are potentially at risk from human activities, and the state of knowledge concerning the potential impacts of forest development is uncertain.

Improving the reliability, completeness and consolidation of habitat information for identified species-at-risk will facilitate clearer, measurable objectives for the sustainable management and enhancement of these species' populations and their habitats today, and enable the monitoring and adaptation of management objectives in the future.

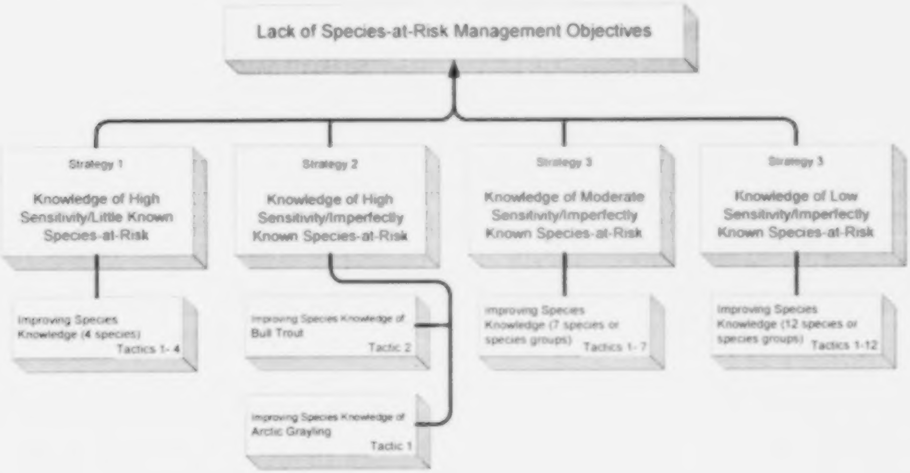

Lack of Species-at-Risk Management Objectives
Strategy 1
Knowledge of High Sensitivity/Little Known Species-at-Risk
Strategy 2
Knowledge of High Sensitivity/Imperfectly Known Species-at-Risk
Strategy 3
Knowledge of Moderate Sensitivity/Imperfectly Known Species-at-Risk
Strategy 3
Knowledge of Low Sensitivity/Imperfectly Known Species-at-Risk
Improving Species Knowledge (4 species) Tactics 1- 4
Improving Species Knowledge of Bull Trout Tactic 2
Improving Species Knowledge of Arctic Grayling Tactic 1
Improving Species Knowledge (7 species or species groups) Tactics 1- 7
Improving Species Knowledge (12 species or species groups) Tactics 1-12

Figure 2.3.1 **Design of the Species-at-Risk Knowledge Solution**

RECOMMENDED SPECIES-AT-RISK KNOWLEDGE SOLUTION

As depicted in Figure 2.3.1, four, key knowledge strategies are recommended which will greatly improve the species-at-risk knowledge base. The strategies correspond to four groups of species, distinguished by the perceived sensitivity to forest management disturbance, and relative state of knowledge of the species and its habitat.

- Species-at-risk that are highly sensitive to forestry activities and for which very little information is currently known (little knowledge);
- Species-at-risk that are highly sensitive to forestry activities and for which some knowledge building initiatives have been undertaken that need to be completed or extended (imperfect knowledge);
- Species-at-risk that are moderately sensitive to forestry activities and the status of knowledge about these species varies (imperfect knowledge); and
- Species-at-risk that have low sensitivity to forestry activities and the status of knowledge about these species varies (imperfect knowledge).

While all of the knowledge strategies are of significant priority due to the risks to and sensitivities of the identified species, priority should be placed on the first category – it should be noted that within each category, the individual species are not prioritised.

While investment funds and scientific capacity are real constraints to strategic implementation, nevertheless there is a need to address multiple strategies, tactics and projects simultaneously. The management goal for all of these species is maintaining habitat quality and diversity, protecting key habitats, and establishing Wildlife Habitat Areas in accordance with the Managing Identified Wildlife Strategy. A full technical description of all recommended strategies is found in Section 3.

STRATEGY 1.KNOWLEDGE OF HIGH SENSITIVITY/LITTLE KNOWN SPECIES

Three species are recognised as the most at-risk of species in the Omineca-Peace Region. The long eared Myotis (bat), broadwinged hawk and a species group of six northeastern warblers are red or blue listed, and knowledge of their behaviour, life history, population size and habitat needs is quite limited. Separate survey and research-related tactics are recommended to address the knowledge gaps associated with these species.

STRATEGY 2.KNOWLEDGE OF HIGH SENSITIVITY/IMPERFECTLY KNOWN SPECIES

Two northern fish species, the arctic grayling and the bull trout are the tactical focus of this second group. Two, separate, yet similar tactical investments are recommended, consisting of four project investments for arctic grayling, and 6 for bull trout. A full, technical description of these tactics and projects is found in Appendix 2.

STRATEGY 3.KNOWLEDGE OF MODERATE SENSITIVITY/IMPERFECTLY KNOWN SPECIES

This strategy consists of knowledge tactics for eight species believed to have moderate sensitivity to forest development disturbance. White sturgeon, wolverine, grizzly bear, fisher, short eared owl, sandhill crane and blue heron are targeted for a wide range of individual knowledge projects, depending on the relative state of knowledge in existence. Wolverine and fisher are the focus of most attention.

STRATEGY 4.KNOWLEDGE LOW SENSITIVITY/IMPERFECTLY KNOWN SPECIES

Eleven of the twelve knowledge tactics associated with this strategy are focussed at bird species, or groups of species. Specific tactical initiatives vary widely, depending on the robustness of the current knowledge base.

Table 2.3.1 presents a detailed schedule of the recommended tactics and projects.

Table 2.3.1 Species-at-Risk Knowledge Solution Summary Table

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. HIGH SENSITIVITY /LITTLE KNOWN SPECIES	1) IMPROVING SPECIES KNOWLEDGE OF THE LONG EARED MYOTIS		1	400000	100000	75000	75000	75000	75000
	2) IMPROVING SPECIES KNOWLEDGE OF THE BROAD WINGED HAWK		1	150000	50000	50000	50000		
	3) IMPROVING SPECIES KNOWLEDGE OF NORTHEASTERN WARBLERS		1	250000	50000	50000	50000	50000	50000
		Recommended Strategy 1 Knowledge Investments		800000	200000	175000	175000	125000	125000
2. HIGH SENSITIVITY /IMPERFECTLY KNOWN SPECIES	1) IMPROVING SPECIES KNOWLEDGE OF ARCTIC GRAYLING	i) Knowledge Gap Analysis	2 a)	50000	50000				
		ii) Inventory and Habitat Mapping	2 b)	500000	100000	100000	100000	100000	100000
		iii) Critical Habitat Mapping	2 b)	750000	150000	150000	150000	150000	150000
		iv) Life History Research and Population Monitoring	2 b)	500000	100000	100000	100000	100000	100000
	2) IMPROVING KNOWLEDGE OF BULL TROUT	i) Knowledge Gap Analysis	2 b)	200000	200000				
		ii) Inventory and Habitat Mapping	2 b)	1500000	300000	300000	300000	300000	300000
		iii) Critical Habitat Mapping	2 b)	1500000	300000	300000	300000	300000	300000
		iv) Habitat Prediction Model Development	2 b)	120000		30000	30000	30000	30000
		vi) Population Monitoring	2 b)	400000	80000	80000	80000	80000	80000
		vii)Forest Development Interaction Research	2 b)	500000	100000	100000	100000	100000	100000
		Recommended Strategy 2 Knowledge Investments		6020000	1380000	1160000	1160000	1160000	1160000
3. MODERATE SENSITIVITY	1) IMPROVING SPECIES KNOWLEDGE OF WHITE STURGEON	i) Population Distribution and Habitat Use	3	900000	180000	180000	180000	180000	180000
		ii) Population Limits Study	3	200000	50000	50000	50000	50000	
		iii) Nechako Population Study	3	1000000	200000	200000	200000	200000	200000
		iv) Forest Development Interactions	3	150000	50000	50000	50000		
		Recommended Sturgeon Tactical Investment		2250000	480000	480000	480000	430000	380000
	2) IMPROVING SPECIES KNOWLEDGE OF WOLVERINE	i) Northern Wolverine Project Reporting	3	25000	25000				
		ii) Critical Habitat Prediction Model Development	3	190000	60000	100000	30000		
		iii) Critical Habitat Decision Support	3	100000				50000	50000
		iv) Habitat Prediction Model Development	3	500000				200000	300000
		v) Wolverine Synecology Study	3	75000	35000	40000			
		vi) Wolverine Management Decision Support	3	100000		50000		50000	
		vii) Population Monitoring Study	3	100000	50000				50000
		Recommended Wolverine Tactical Investment		5590000	1130000	1150000	990000	1165000	1160000
	3) IMPROVING SPECIES KNOWLEDGE OF GRIZZLY BEAR		3	650000	150000	150000	150000	100000	100000
	4) IMPROVING SPECIES KNOWLEDGE OF FISHER	i) Fisher/forest Development Interactions	3	40000	40000				
		ii) Fisher Population Research	3	320000	80000	80000	80000	80000	
		iii) Fisher Critical Habitat Research	3	70000	35000	35000			
		iv) Fisher Habitat Assessment Methods	3	20000	10000	10000			
		v) Fisher Management Decision Support Tools - Initial	3	30000	15000	15000			
		vi) Fisher Management Decision Support Tools - Improved	3	500000	100000	100000	100000	100000	100000
		vii) Fisher Population Monitoring Pilot Study	3	50000	50000				
		Recommended Fisher Tactical Investment		12860000	2740000	2890000	2310000	2600000	2520000

Table 2.3.1 Species-at-Risk Knowledge Solution Summary Table

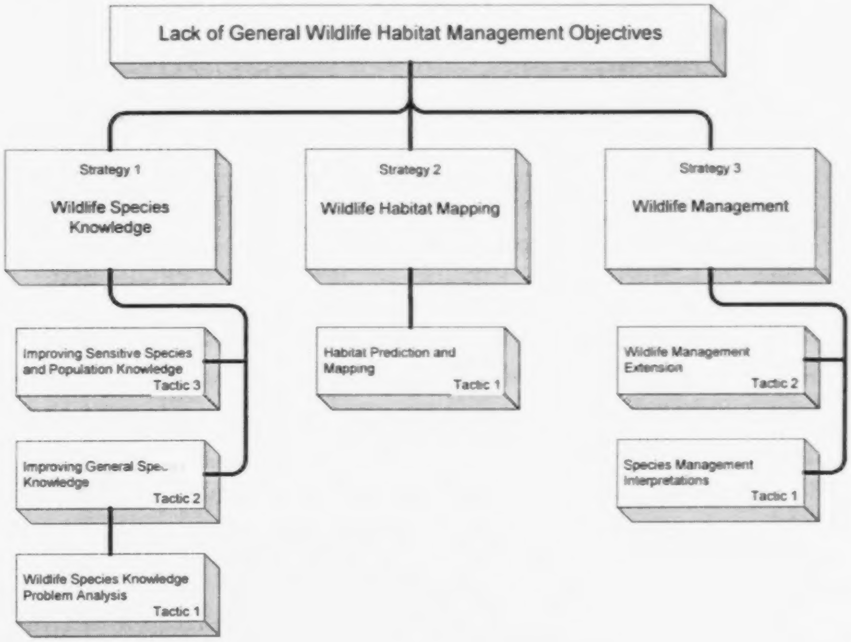
KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. HIGH SENSITIVITY /LITTLE KNOWN SPECIES	1) IMPROVING SPECIES KNOWLEDGE OF THE LONG EARED MYOTIS		1	400000	▨	▨	▨	▨	▨
	2) IMPROVING SPECIES KNOWLEDGE OF THE BROAD WINGED HAWK		1	150000	▨	▨	▨		
	3) IMPROVING SPECIES KNOWLEDGE OF NORTHEASTERN WARBLERS		1	250000	▨	▨	▨	▨	▨
		Recommended Strategy 1 Knowledge Investments		**800000**	**200000**	**175000**	**175000**	**125000**	**125000**
2. HIGH SENSITIVITY /IMPERFECTLY KNOWN SPECIES	1) IMPROVING SPECIES KNOWLEDGE OF ARCTIC GRAYLING	i) Knowledge Gap Analysis	2 a)	50000	▨				
		ii) Inventory and Habitat Mapping	2 b)	500000	▨	▨	▨	▨	▨
		iii) Critical Habitat Mapping	2 b)	750000	▨	▨	▨	▨	▨
		iv) Life History Research and Population Monitoring	2 b)	500000	▨	▨	▨	▨	▨
	2) IMPROVING KNOWLEDGE OF BULL TROUT	i) Knowledge Gap Analysis	2 b)	200000	▨				
		ii) Inventory and Habitat Mapping	2 b)	1500000	▨	▨	▨	▨	▨
		iii) Critical Habitat Mapping	2 b)	1500000	▨	▨	▨	▨	▨
		Iv) Habitat Prediction Model Development	2 b)	120000		▨	▨	▨	▨
		vi) Population Monitoring	2 b)	400000	▨	▨	▨	▨	▨
		vii)Forest Development Interaction Research	2 b)	500000	▨	▨	▨	▨	▨
		Recommended Strategy 2 Knowledge Investments		**6020000**	**1380000**	**1160000**	**1160000**	**1160000**	**1160000**
3. MODERATE SENSITIVITY	1) IMPROVING SPECIES KNOWLEDGE OF WHITE STURGEON	i) Population Distribution and Habitat Use	3	900000	▨	▨	▨	▨	▨
		ii) Population Limits Study	3	200000	▨	▨	▨	▨	
		iii) Nechako Population Study	3	1000000	▨	▨	▨	▨	▨
		iv) Forest Development Interactions	3	150000	▨	▨	▨		
		Recommended Sturgeon Tactical Investment		**2250000**	▨	▨	▨	▨	▨
	2) IMPROVING SPECIES KNOWLEDGE OF WOLVERINE	i) Northern Wolverine Project Reporting	3	25000	▨				
		ii) Critical Habitat Prediction Model Development	3	190000	▨	▨	▨		
		iii) Critical Habitat Decision Support	3	100000				▨	▨
		iv) Habitat Prediction Model Development	3	500000				▨	▨
		v) Wolverine Synecology Study	3	75000	▨	▨			
		vi) Wolverine Management Decision Support	3	100000		▨		▨	
		vii) Population Monitoring Study	3	100000	▨				▨
		Recommended Wolverine Tactical Investment		**5590000**	▨	▨	▨	▨	▨
	3) IMPROVING SPECIES KNOWLEDGE OF GRIZZLY BEAR		3	650000	▨	▨	▨	▨	▨
	4) IMPROVING SPECIES KNOWLEDGE OF FISHER	i) Fisher/forest Development Interactions	3	40000	▨				
		ii) Fisher Population Research	3	320000	▨	▨	▨	▨	
		iii) Fisher Critical Habitat Research	3	70000	▨	▨			
		Iv) Fisher Habitat Assessment Methods	3	20000	▨	▨			
		v) Fisher Management Decision Support Tools - Initial	3	30000	▨	▨			
		v) Fisher Management Decision Support Tools - Improved	3	500000	▨	▨	▨	▨	▨
		vi) Fisher Population Monitoring Pilot Study	3	50000	▨				
		Recommended Fisher Tactical Investment		**12860000**	▨	▨	▨	▨	▨

				Investment by Period ($/year)				
	5) IMPROVING SPECIES KNOWLEDGE OF SHORT EARED OWL	3	300000	▨	▨			
	6) IMPROVING SPECIES KNOWLEDGE OF GREATER SANDHILL CRANE	3	100000	▨	▨			
	7) IMPROVING SPECIES KNOWLEDGE OF GREAT BLUE HERON	3	100000	▨	▨			
Recommended Strategy 3 Knowledge Investments			**26220000**	5730000	5630000	4620000	5200000	5040000
4. LOW SENSITIVITY /IMPERFECTLY KNOWN SPECIES	1) IMPROVING SPECIES KNOWLEDGE FOR THE AMERICAN BITTERN	4	50000	▨				
	2) IMPROVING SPECIES KNOWLEDGE FOR THE BOBOLINK	4	50000	▨				
	3) IMPROVING SPECIES KNOWLEDGE FOR THE LONG-BILLED CURLEW	4	100000	▨	▨			
	4) IMPROVING SPECIES KNOWLEDGE FOR THE LEWIS'S WOODPECKER	4	50000	▨				
	5) IMPROVING SPECIES KNOWLEDGE FOR THE SHARP-TAILED GROUSE	4	200000	▨	▨	▨	▨	
	6) IMPROVING SPECIES KNOWLEDGE FOR THE TRUMPETER SWAN	4	150000	▨	▨	▨		
	7) IMPROVING SPECIES KNOWLEDGE FOR THE PEREGRINE FALCON	4	100000	▨	▨			
	8) IMPROVING SPECIES KNOWLEDGE FOR THE AMERICAN WHITE PELICAN	4	100000	▨	▨			
	9) IMPROVING SPECIES KNOWLEDGE FOR THE UPLAND SANDPIPER	4	150000	▨	▨	▨		
	10) IMPROVING SPECIES KNOWLEDGE FOR THE SURF SCOTER	4	150000	▨	▨	▨		
	11) IMPROVING SPECIES KNOWLEDGE FOR THE NELSON'S SHARP TAILED AND LE CONTE'S SPARROWS	4	150000	▨	▨	▨		
	12) IMPROVING SPECIES KNOWLEDGE FOR THE RED AND BLUE LISTED PLANT SPECIES AND ASSOCIATIONS	4	100000	▨	▨			
Recommended Strategy 4 Knowledge Investments			**1350000**	600000	400000	290000	50000	0
Total Recommended Species-at-Risk Knowledge Solution Investment			**$309770000 0**	1200000	3095980 000	500000	100000	0

				Investment by Period ($/year)				
	5) IMPROVING SPECIES KNOWLEDGE OF SHORT EARED OWL	3	300000	150000	150000			
	6) IMPROVING SPECIES KNOWLEDGE OF GREATER SANDHILL CRANE	3	100000	50000	50000			
	7) IMPROVING SPECIES KNOWLEDGE OF GREAT BLUE HERON	3	100000	50000	50000			
	Recommended Strategy 3 Knowledge Investments		**26220000**	5730000	5630000	4620000	5280000	5040000
4. LOW SENSITIVITY /IMPERFECTLY KNOWN SPECIES	1) IMPROVING SPECIES KNOWLEDGE FOR THE AMERICAN BITTERN	4	50000	50000				
	2) IMPROVING SPECIES KNOWLEDGE FOR THE BOBOLINK	4	50000	50000				
	3) IMPROVING SPECIES KNOWLEDGE FOR THE LONG-BILLED CURLEW	4	100000	50000	50000			
	4) IMPROVING SPECIES KNOWLEDGE FOR THE LEWIS'S WOODPECKER	4	50000	50000				
	5) IMPROVING SPECIES KNOWLEDGE FOR THE SHARP-TAILED GROUSE	4	200000	50000	50000	50000	50000	
	6) IMPROVING SPECIES KNOWLEDGE FOR THE TRUMPETER SWAN	4	150000	50000	50000	50000		
	7) IMPROVING SPECIES KNOWLEDGE FOR THE PEREGRINE FALCON	4	100000	50000	50000			
	8) IMPROVING SPECIES KNOWLEDGE FOR THE AMERICAN WHITE PELICAN	4	100000	50000	50000			
	9) IMPROVING SPECIES KNOWLEDGE FOR THE UPLAND SANDPIPER	4	150000	50000	50000	50000		
	10) IMPROVING SPECIES KNOWLEDGE FOR THE SURF SCOTER	4	150000	50000	50000	50000		
	11) IMPROVING SPECIES KNOWLEDGE FOR THE NELSON'S SHARP TAILED AND LE CONTE'S SPARROWS	4	150000	50000	50000	50000		
	12) IMPROVING SPECIES KNOWLEDGE FOR THE RED AND BLUE LISTED PLANT SPECIES AND ASSOCIATIONS	4	100000	50000	50000			
	Recommended Strategy 4 Knowledge Investments		**1350000**	600000	450000	250000	50000	0
Total Recommended Species-at-Risk Knowledge Solution Investment			**$3097700000**	1200000	3095900000	500000	100000	0

ISSUE 4 LACK OF GENERAL WILDLIFE MANAGEMENT OBJECTIVES

General populations of wildlife and habitat availability are potentially at risk from forest development activities, yet an understanding of the causes and effects is lacking. The census is incomplete for most populations as is habitat information for wildlife species not currently considered at risk (e.g. moose, elk, deer, pine marten and mountain goat). Improving the reliability, completeness and consolidation of wildlife habitat information will establish clearer and measurable management objectives for sustainable wildlife habitat management today and enable the monitoring and adaptation of the management objectives in the future.



Lack of General Wildlife Habitat Management Objectives
Strategy 1
Wildlife Species Knowledge
Strategy 2
Wildlife Habitat Mapping
Strategy 3
Wildlife Management
Improving Sensitive Species and Population Knowledge
Tactic 3
Improving General Spe
Knowledge
Tactic 2
Wildlife Species Knowledge Problem Analysis
Tactic 1
Habitat Prediction and Mapping
Tactic 1
Wildlife Management Extension
Tactic 2
Species Management Interpretations
Tactic 1

Figure 2.4.1 **Design of the General Wildlife Management Knowledge Solution**

RECOMMENDED GENERAL WILDLIFE MANAGEMENT KNOWLEDGE SOLUTION

As depicted in Figure 2.4.1, three key, knowledge strategies are recommended as the knowledge solution to address this issue:

- Wildlife Species Knowledge Strategy;
- Wildlife Habitat Mapping Strategy; and
- Wildlife Management Strategy.

These strategies are separate, but complimentary in their design. If implemented together, they will enhance the acquisition and assembly of the components of knowledge needed to support the required clarity of SFM species management objectives. A full, technical discussion of each strategy is found in Section 3.

STRATEGY 1.WILDLIFE SPECIES KNOWLEDGE

This knowledge strategy relies on three integrated tactics, all designed to address gaps in the state of knowledge of general wildlife species. The first tactic, a knowledge gap analysis, should be implemented immediately to ensure that subsequent investigations in related tactics target the highest priority knowledge needs first. This gap analysis will identify, or confirm knowledge limiting general wildlife management issues, including sustainable forest development and access management impacts, designation of conservation measures such as WHA's, SA's OGMA's and PMP zones. Recommendations resulting from the analysis will influence the priorities assigned in other tactics and strategies.

The second tactic directs four broad activities designed to enhance knowledge of species of current interest: moose, elk, mountain goat and pine marten. Depending on the state of the existing knowledge, these activities address population abundance, composition, distribution, reproductive performance, critical habitats and sensitivity to disturbance.

The third tactic in this strategy is designed to address species, or local populations identified in tactic 1 as sensitive to general or specific forest development and hunting pressures.

STRATEGY 2.WILDLIFE HABITAT MAPPING

Wildlife habitat mapping is incomplete for most species largely because bio-terrain mapping (PEM) has yet to be fully implemented throughout the regions. While full implementation of the Ecosystem Mapping Tactic of the VRI Strategy is a necessary pre-requisite, the habitat mapping strategy must be implemented for high priority management units and wildlife species needs. Habitat maps and suitability/capability interpretations rely on the development of suitable habitat prediction models. Habitat models require reliable ecological information; in some geographic areas this requires the collection of new base data. All data must be available in a "model-ready" format. These habitat data input criteria must also be recognised and accommodated in other data-related strategies, most notably VRI, and various species-specific strategies of this and the Species-at-Risk issue.

Accordingly, a single, multi-activity tactic is recommended for implementing this strategy. Three complimentary, region-wide activities will address the following tactical needs:

- consolidation and assembly of existing habitat data and information;
- refinement of existing, or design and development of new habitat prediction models; and
- survey, assessment and collection of habitat feature data and information.

STRATEGY 3.WILDLIFE MANAGEMENT

This strategy consists of two tactics. Tactic 1 is comprised of five project (surveys, monitoring and research) initiatives designed to produce sound management interpretations, guidelines and "best practice" recommendations. Initially, the following species are should receive this analysis:

- Mountain goat;
- Goshawk
- Pine marten;
- Songbirds; and
- Furbearers.

The second tactic, Wildlife Management Extension, is designed to improve the awareness and access to wildlife information of resource managers in the Omineca-Peace Region.

Table 2.4.1 presents a detailed schedule of the recommended tactics and projects.

Table 2.4.1 General Wildlife Management Knowledge Solution Summary Table

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. WILDLIFE SPECIES KNOWLEDGE	1) WILDLIFE SPECIES KNOWLEDGE PROBLEM ANALYSIS		1	50000	30000	5000	5000	5000	5000
	2) IMPROVING GENERAL SPECIES KNOWLEDGE	i) Moose	4 a)	250000	50000	50000	50000	50000	50000
		ii) Mountain Goat	4 b)	250000	50000	50000	50000	50000	50000
		iii) Elk	4 c)	250000	50000	50000	50000	50000	50000
		iv) Pine Marten	4 d)	250000	50000	50000	50000	50000	50000
	3) IMPROVING SENSITIVE SPECIES AND POPULATION KNOWLEDGE		3	250000		100000	50000	50000	50000
Recommended Wildlife Species Knowledge Investment				**1300000**	**230000**	**305000**	**255000**	**255000**	**255000**
2. WILDLIFE HABITAT MAPPING	1) HABITAT PREDICTION AND MAPPING	i) Habitat Data Assembly	3	50000	30000	5000	5000	5000	5000
		ii) Habitat Prediction Modelling	2	320000	20000	50000	50000	100000	100000
		iii) Habitat Features Data	3	50000	30000	5000	5000	5000	5000
Recommended Wildlife Habitat Mapping Strategic Knowledge Investment				**420000**	**80000**	**60000**	**60000**	**110000**	**110000**
3. WILDLIFE MANAGEMENT INTERPRETATIONS	1) SPECIES MANAGEMENT INTERPRETATIONS	i) Mountain Goat	5 a)	30000		10000	10000	5000	5000
		ii) Goshawk	5 b)	80000	50000	10000	10000	5000	5000
		iii) Pine Marten	5 c)	30000		10000	10000	5000	5000
		iv) Songbirds	5 d)	30000		10000	10000	5000	5000
		v) Furbearers	5 e)	120000	10000	50000	50000	5000	5000
	2) WILDLIFE MANAGEMENT EXTENSION		5 f)	225000	25000	50000	50000	50000	50000
Recommended Wildlife Management Interpretations Strategic Knowledge Investments				**515000**	**85000**	**140000**	**140000**	**75000**	**75000**
Total Recommended General Wildlife Management Knowledge Solution Investment				**$2380000**	**170000**	**280000**	**280000**	**150000**	**1500000**

Figure 2.4.2 depicts some of the obvious interactions and linkages within and between the three strategies making up the General Wildlife Management Knowledge Solution.

Wildlife Species Knowledge Strategy
Tactic 1 (Problem Analysis) is a key initiative, and provides technical direction to future expansion of Tactics 2 and 3. The initial focus of Tactics 2 and 3, however, enable immediate investment action. There is also a functional interaction between these tactics and the Wildlife Habitat Mapping Strategy. Knowledge produced in this strategy flows to Tactics 1 and 2 of the Wildlife Management Strategy.

Wildlife Habitat Mapping Strategy
Knowledge produced in the single tactic of this strategy flows to Tactics 1 and 2 of the Wildlife Management Strategy.

The second tactic, Wildlife Management Extension, is designed to improve the awareness and access to wildlife information of resource managers in the Omineca-Peace Region.

Table 2.4.1 presents a detailed schedule of the recommended tactics and projects.

Table 2.4.1 General Wildlife Management Knowledge Solution Summary Table

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. WILDLIFE SPECIES KNOWLEDGE	1) WILDLIFE SPECIES KNOWLEDGE PROBLEM ANALYSIS		1	50000	▨	▨	▨	▨	▨
	2) IMPROVING GENERAL SPECIES KNOWLEDGE	i) Moose	4 a)	250000	▨	▨	▨	▨	▨
		ii) Mountain Goat	4 b)	250000	▨	▨	▨	▨	▨
		iii) Elk	4 c)	250000	▨	▨	▨	▨	▨
		iv) Pine Marten	4 d)	250000	▨	▨	▨	▨	▨
	3) IMPROVING SENSITIVE SPECIES AND POPULATION KNOWLEDGE		3	250000		▨	▨	▨	▨
Recommended Wildlife Species Knowledge Investment				**1300000**	230000	305000	255000	255000	255000
2. WILDLIFE HABITAT MAPPING	1) HABITAT PREDICTION AND MAPPING	i) Habitat Data Assembly	3	50000	▨	▨	▨	▨	▨
		ii) Habitat Prediction Modelling	2	320000	▨	▨	▨	▨	▨
		iii) Habitat Features Data	3	50000	▨	▨	▨	▨	▨
Recommended Wildlife Habitat Mapping Strategic Knowledge Investment				**420000**	80000	60000	60000	110000	110000
3. WILDLIFE MANAGEMENT INTERPRETATIONS	1) SPECIES MANAGEMENT INTERPRETATIONS	i) Mountain Goat	5 a)	30000		▨	▨	▨	▨
		ii) Goshawk	5 b)	80000	▨	▨	▨	▨	▨
		iii) Pine Marten	5 c)	30000		▨	▨	▨	▨
		iv) Songbirds	5 d)	30000		▨	▨	▨	▨
		v) Furbearers	5 e)	120000	▨	▨	▨	▨	▨
	2) WILDLIFE MANAGEMENT EXTENSION		5 f)	225000	▨	▨	▨	▨	▨
Recommended Wildlife Management Interpretations Strategic Knowledge Investments				**515000**	85000	140000	140000	75000	75000
Total Recommended General Wildlife Management Knowledge Solution Investment				**$2380000**	170000	280000	280000	150000	1500000

Figure 2.4.2 depicts some of the obvious interactions and linkages within and between the three strategies making up the General Wildlife Management Knowledge Solution.

Wildlife Species Knowledge Strategy
Tactic 1 (Problem Analysis) is a key initiative, and provides technical direction to future expansion of Tactics 2 and 3. The initial focus of Tactics 2 and 3, however, enable immediate investment action. There is also a functional interaction between these tactics and the Wildlife Habitat Mapping Strategy. Knowledge produced in this strategy flows to Tactics 1 and 2 of the Wildlife Management Strategy.

Wildlife Habitat Mapping Strategy
Knowledge produced in the single tactic of this strategy flows to Tactics 1 and 2 of the Wildlife Management Strategy.

Wildlife Management Strategy

The knowledge producing Tactic 1 (Species Management Interpretations) flows to the Extension Tactic 2. This tactic should also serve the extension requirements of the Caribou Management Knowledge Solution.

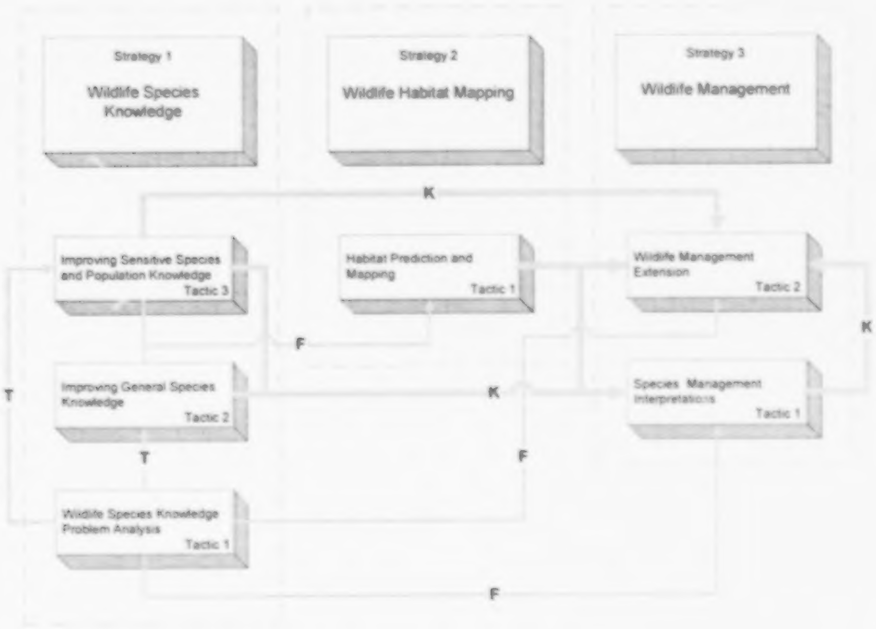

Strategy 1
Wildlife Species Knowledge
Strategy 2
Wildlife Habitat Mapping
Strategy 3
Wildlife Management
K
Improving Sensitive Species and Population Knowledge
Tactic 3
Habitat Prediction and Mapping
Tactic 1
Wildlife Management Extension
Tactic 2
F
K
Improving General Species Knowledge
Tactic 2
K
Species Management Interpretations
Tactic 1
T
T
F
Wildlife Species Knowledge Problem Analysis
Tactic 1
F

Figure 2.4.2 Interactions and linkages within the General Wildlife Management Knowledge Solution.

ISSUE 5 UNKNOWN NATURAL DISTURBANCE, BIODIVERSITY AND NATURAL SUCCESSION DYNAMICS

Sustainable Forest Management incorporates forest condition objectives, which are intended to approximate the range of variability of the historic temporal and spatial patterns of forest distribution and seral stage conditions in the landscape. Certain aspects of this natural range of variability are poorly understood for the Omineca-Peace region. Adequate methods of monitoring and setting targets for biodiversity are also lacking and our knowledge of natural successional dynamics and processes is incomplete. These key knowledge gaps prevent meaningful habitat projections, accurate estimates for forest productivity and yields, and the development of effective biodiversity management strategies.

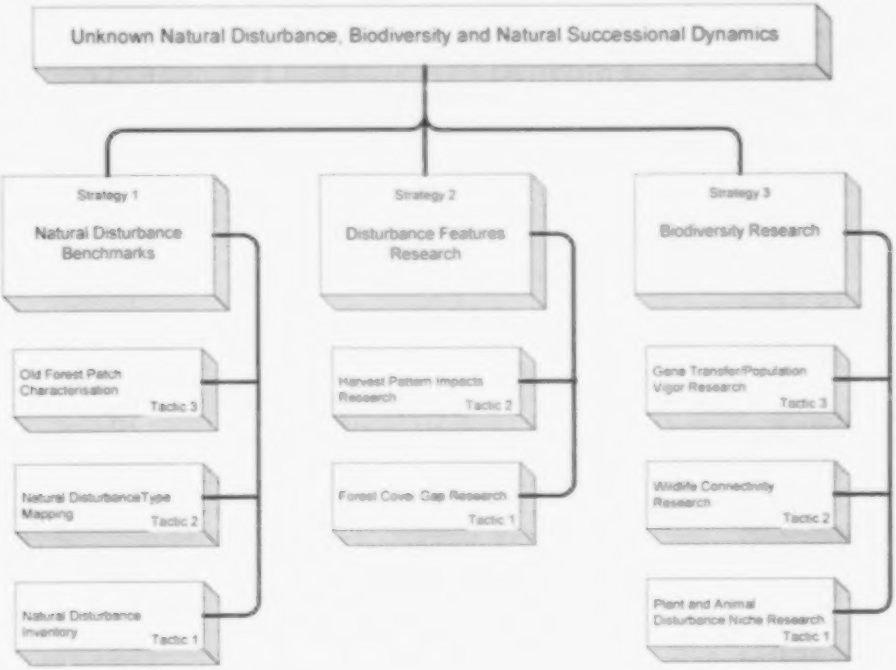

Unknown Natural Disturbance, Biodiversity and Natural Successional Dynamics
Strategy 1
Natural Disturbance Benchmarks
Strategy 2
Disturbance Features Research
Strategy 3
Biodiversity Research
Old Forest Patch Characterisation
Tactic 3
Natural DisturbanceType Mapping
Tactic 2
Natural Disturbance Inventory
Tactic 1
Harvest Pattern Impacts Research
Tactic 2
Forest Cover Gap Research
Tactic 1
Gene Transfer/Population Vigor Research
Tactic 3
Wildlife Connectivity Research
Tactic 2
Plant and Animal Disturbance Niche Research
Tactic 1

Figure 2.5.1 **Design of the Natural Disturbance, Biodiversity and Natural Succession Dynamics Knowledge Solution**

RECOMMENDED NATURAL DISTURBANCE, BIODIVERSITY AND NATURAL SUCCESSION DYNAMICS KNOWLEDGE SOLUTION

As depicted in Figure 2.5.1, the recommended knowledge solution consists of three strategies. Strategy 1 is designed to explore the characteristics and variation of stand and landscape disturbance in the natural forest. Strategy 2 and 3 enhance, through applied research, knowledge of specific disturbance features, and biodiversity, respectively. A full, technical description of the strategies is found in Section 3.

STRATEGY 1.NATURAL DISTURBANCE BENCHMARKS

This strategy consists of three tactics. The first calls for an inventory of the forest structural elements, which reflect natural disturbance, biodiversity, and successional dynamics. This inventory initiative should be completed in all districts within the Omineca Peace Region. Some districts may have portions of the inventory completed. A multi-resource, multi-level, multi-variable inventory data collection procedure is advocated, whereby as many inventory data elements are estimated as possible in a single inventory sample plan.

The second tactic addresses known errors in the classification of several Natural DisturbanceTypes (NDT's). Improved information is now available, and should be incorporated into the regional map base.

The third tactic addresses a need for better definition of natural disturbance features, specifically old forest patches. Old patch size information is sparse, and has been extrapolated from current information. The values assigned to maintain old forest patch size distribution would have a direct impact on landscape unit planning and future management of the land base. In order to enhance the effectiveness of SFM, this tactic will ensure that old forest patch characteristics are benchmarked with the natural forest condition.

STRATEGY 2.DISTURBANCE FEATURES RESEARCH

This strategy consists of two research and development tactics aimed at improving understanding of the structure and function of natural disturbance features. The first tactic embodies two integrated project initiatives designed to investigate and analyse natural disturbance inventory information, in combination with selected empirical studies, to compare and contrast the structural characteristics of natural and managed forests. The purpose of these initiatives is to detect variation, between natural and managed states, in the frequency and pattern of forest canopy gaps (non-forest vegetation patches), and to explore and recommend forest management options for simulating natural patterns in managed landscapes.

The second tactic addresses the need for resolution of the debate concerning the impacts to natural disturbance patterns and biodiversity of silvicultural systems and harvest pattern design. The recommended initiative will evaluate the cumulative, forest level effects of access and disturbance associated with various harvest patterns.

STRATEGY 3.BIODIVERSITY RESEARCH

This knowledge strategy consists of three research and development initiatives recommended to address the sub-issue of biodiversity – its definition and characterisation. Tactic 1 is and investigation of the relationship between plant and animal habitat requirements, and natural disturbance. Resulting information and knowledge will facilitate better management decisions to mimic natural disturbance features and patterns.

The second tactic explores the concept of wildlife connectivity in the landscape. A review will be undertaken to determine the validity of this concept in the Omineca-Peace Region.

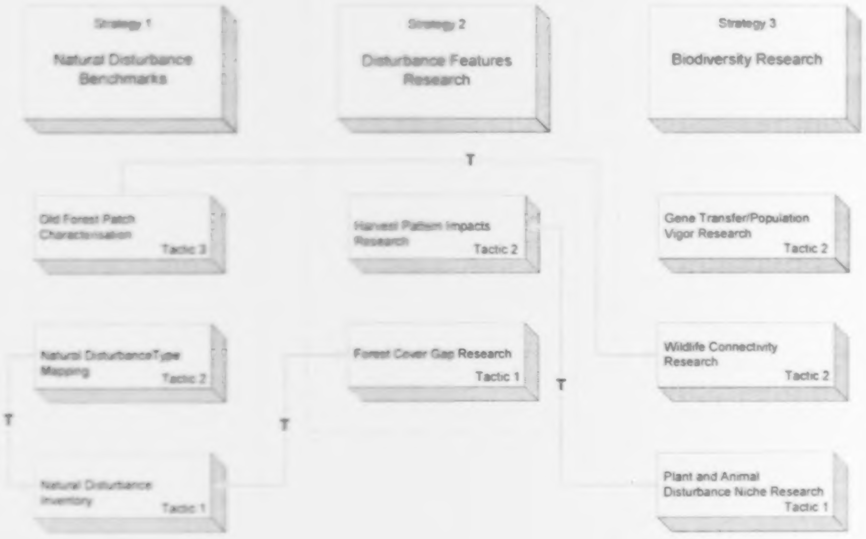
The third tactic explores the concept of genetic exchange within a population as an indicator of the vigour and relative health.

Table 2.5.1 presents a detailed schedule of the recommended strategies, tactics and projects.

Table 2.5.1 **Natural Disturbance, Biodiversity and Natural Succession Dynamics Knowledge Solution Investment Summary.**

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. NATURAL DISTURBANCE BENCHMARKS	1) NATURAL DISTURBANCE INVENTORY		1	10000000	2000000	2000000	2000000	2000000	2000000
	2) NATURAL DISTURBANCE TYPE MAPPING		2	30000	30000				
	3) OLD FOREST PATCH CHARACTERISATION		4	650000	100000	100000	150000	150000	150000
Recommended Natural Disturbance Benchmarks Strategic Knowledge Investments				**10680000**	**2130000**	**2100000**	**2150000**	**2150000**	**2150000**
2. DISTURBANCE FEATURES RESEARCH	1) FOREST COVER GAP RESEARCH	i) Forest Cover Gap Data Analysis and Interpretation	5	1150000	100000	250000	250000	250000	300000
		ii) Forest Cover Gap Empirical Research	7	750000	150000	150000	150000	150000	150000
	2) HARVEST PATTERN IMPACTS RESEARCH		6	750000	150000	150000	150000	150000	150000
Recommended Disturbance Features Strategic Knowledge Investments				**2650000**	**400000**	**550000**	**560000**	**550000**	**600000**
3. BIODIVERSITY RESEARCH	1) PLANT/ANIMAL DISTURBANCE NICHE RESEARCH		3	130000	100000	30000			
	2) WILDLIFE CONNECTIVITY RESERACH		8	350000	80000	220000	50000		
	3) GENE TRANSFER/POPULATION VIGOR RESEARCH		9	480000	[illegible]	[illegible]	[illegible]		
Recommended Biodiversity Strategic Knowledge Investments				**960000**	**300000**	**500000**	**100000**	**0**	**0**
Total Recommended Natural Disturbance and Biodiversity Knowledge Solution Investments				**$14,919,000**	2880000	3150000	2800000	2950000	2915000

Figure 2.5.2 depicts the simple interactions and linkages within and between the three strategies making up the knowledge solution.



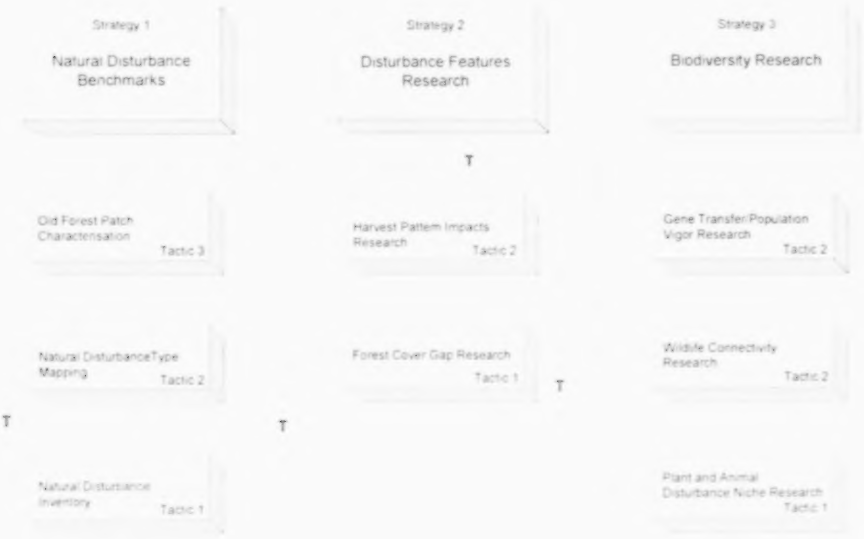
Strategy 1
Natural Disturbance Benchmarks
Strategy 2
Disturbance Features Research
Strategy 3
Biodiversity Research
T
Old Forest Patch Characterisation
Tactic 3
Harvest Pattern Impacts Research
Tactic 2
Gene Transfer/Population Vigor Research
Tactic 2
Natural DisturbanceType Mapping
Tactic 2
Forest Cover Gap Research
Tactic 1
T
Wildlife Connectivity Research
Tactic 2
T
T
Natural Disturbance Inventory
Tactic 1
Plant and Animal Disturbance Niche Research
Tactic 1

Figure 2.5.2 **Interactions and linkages within the Natural Disturbance, Biodiversity and Succession Benchmarks Knowledge Solution.**

Table 2.5.1 **Natural Disturbance, Biodiversity and Natural Succession Dynamics Knowledge Solution Investment Summary.**

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. NATURAL DISTURBANCE BENCHMARKS	1) NATURAL DISTURBANCE INVENTORY		1	10000000					
	2) NATURAL DISTURBANCE TYPE MAPPING		2	30000					
	3) OLD FOREST PATCH CHARACTERISATION		4	650000					
	Recommended Natural Disturbance Benchmarks Strategic Knowledge Investments			**10680000**	2130000	2100000	2150000	2150000	2150000
2. DISTURBANCE FEATURES RESEARCH	1) FOREST COVER GAP RESEARCH	i) Forest Cover Gap Data Analysis and Interpretation	5	1150000					
		ii) Forest Cover Gap Empirical Research	7	750000					
	2) HARVEST PATTERN IMPACTS RESEARCH		6	750000					
	Recommended Disturbance Features Strategic Knowledge Investments			**2650000**	400000	550000	550000	550000	600000
3. BIODIVERSITY RESEARCH	1) PLANT/ANIMAL DISTURBANCE NICHE RESEARCH		3	130000					
	2) WILDLIFE CONNECTIVITY RESERACH		8	350000					
	3) GENE TRANSFER/POPULATION VIGOR RESEARCH		9	480000					
	Recommended Biodiversity Strategic Knowledge Investments			**960000**	360000	500000	100000	0	0
Total Recommended Natural Disturbance and Biodiversity Knowledge Solution Investments				**$14,819,000**	2890000	3150000	2800000	2950000	2915000

Figure 2.5.2 depicts the simple interactions and linkages within and between the three strategies making up the knowledge solution.


Strategy 1
Natural Disturbance Benchmarks
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Tactic 1
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Wildlife Connectivity Research
Tactic 2
T
T
Natural Disturbance Inventory
Tactic 1
Plant and Animal Disturbance Niche Research
Tactic 1

Figure 2.5.2 **Interactions and linkages within the Natural Disturbance, Biodiversity and Succession Benchmarks Knowledge Solution.**

ISSUE 6 INADEQUATE SUSTAINABLE FOREST MANAGEMENT DECISION SUPPORT TOOLS

The nature of this SSFM issue is distinct from the twelve others in the RMP. During the issue identification phase of this analysis in 2000/2001, regional stakeholders complained of being poorly served by decision support tools. This response was common to most of the twelve, technical or discipline-specific issues, yet no respondents defined specifically what was needed to correct the situation. As a result of this apparently overarching, poorly defined nature, the tactical planning team undertook an integrative, rather than reductive approach to the issue of decision support. This section serves three purposes:

- to propose a conceptual model of decision support within the practice of Sustainable Forest Management
- to present a classification scheme for decision support tools that will facilitate analysis and comparison of the potential contributions of the knowledge investments recommended in this report; and
- to identify potential decision support gaps and recommend additional decision-support investments where necessary.

A SUSTAINABLE FOREST MANAGEMENT DECISION-MAKING MODEL

A precise statement of the problem is required. Since the issue focuses on decision support for SFM managers, the potential complexity of the problem is enormous considering the multi-disciplinary nature of sustainable forest management, and the vast array of types of decisions and management levels involved.

A Decision-maker's Sphere of Inference

A decision is simply a choice of one from among a number of alternatives. A simple model of sustainable forest management decision-making is represented in Figure 2.6.1. The forest resources manager is depicted as a decision-maker operating within a personally defined sphere of inference. The decision-making process depends on the awareness and judgement of the decision-maker (personal cognitive abilities) to reach a conclusion regarding a sustainable forest management problem (Figure 2.6.2). SFM decision-making usually involves some form of problem analysis based on a number of management assumptions (policies, facts, hypotheses, beliefs and premises). These inputs to the decision are depicted as dashed lines in Figure 2.6.2, since some cases SFM decisions may be reached without awareness by the decision-maker that a problem actually exists. Similarly, some decisions may be based on faulty management assumptions, such as incorrect "facts", untested hypotheses, or flawed premises.

decision-maker

Figure 2.6.1 Sustainable Forest Manager's sphere of inference

In addition to the judgement of the decision-maker, three factors largely determine the quality of SFM decision-making: the decision-maker's awareness of the SFM problem; the ability to anticipate SFM problems that might result from the decision; and the veracity of the premises used as the basis of the decision. SFM knowledge investments directly address these factors.

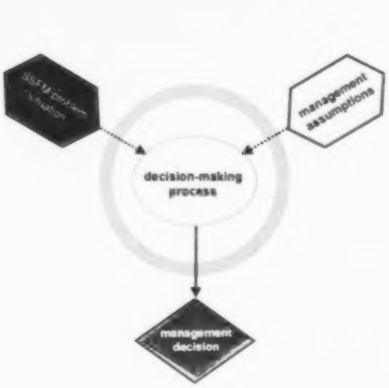

Figure 2.6.2 Sustainable Forest Manager's sphere of inference, and the role of management assumptions and situational problems in the decision process.

Decision Support Resources

In addition to personal, cognitive skills and abilities, the decision-maker relies on three types of decision support resources: data, information and knowledge. In most cases, they take one or other of the following forms:[25]

Data:

- initial, "raw" unprocessed empirical data;
- data available from previous experience;
- data as a decision result.

Information:

- readily available at the start of the decision process;
- obtained from processed data or other information;
- available outside the organisation.

Knowledge:

- processed at the start of the decision process;
- "know-how" of adding decision value – converting raw data into information, or extracting final data from information;
- newly acquired in the decision-making process.

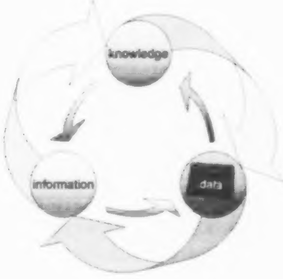

Figure 2.6.3 Three elements of the decision-makers support resources.

The three elements of decision-support are represented in Figure 2.6.3 as a circular continuum with two, dominant directions.

The most commonly understood relationship between the three elements is a linear, hierarchical progression from data to knowledge; data is collected and processed into information, which is evaluated against existing knowledge, or stimulates the search for and creation of new knowledge. For example, many of the recommended inventory investments

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[25] Skyrius, R. 2001. Business decision making, managerial learning and information technology. Univerisity of Vilnius, Lithuania. Proceedings of the 2001 Informing Science Conference, Krakow, Poland. June19-22, Cracow University of Economics, Krakow, Poland.

(including VRI, Ecosystem Mapping, Wildlife, Species-at-risk and Fisheries) represent this relationship.

Other relationships are known, or suspected to exist, however, such as:

Knowledge – Information – Data: knowledge is required to facilitate a search for information, and then transform it to data.

Knowledge – Data – Information: knowledge is required to locate data, in order to produce the required information.

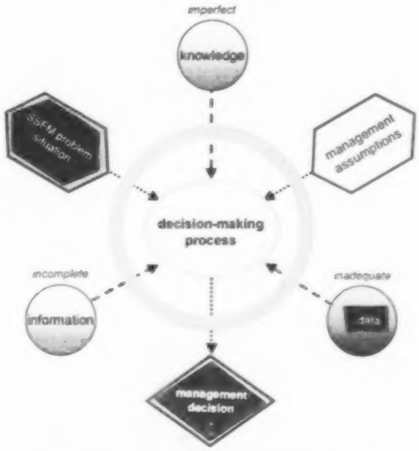
Data – Knowledge – Information: knowledge is required to process data into information.

Still other relationships may be possible, depending on the nature of the science or technology, but the continuous, circular structure of Figure 2.6.3 allows sufficient flexibility to account for most starting points and linkages.

The Decision Support Environment

Figure 2.6.4 depicts the usually imperfect decision environment most SFM decision-makers confront.

Figure 2.6.4 The imperfect environment of Sustainable Forest Management Decision-making.



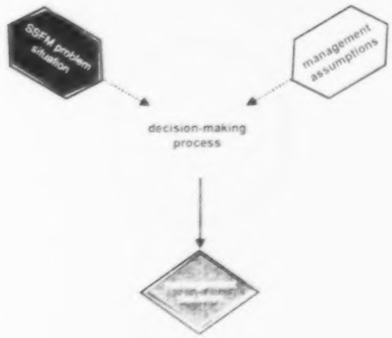
Sustainable forest managers usually opt, whenever possible, to use all available decision-support resources as the basis for most important decisions. Rarely, however, are data sets adequate, is information complete, or knowledge perfect. This is the environment within which managers must make decisions, and the circumstances for which this SSFM plan was designed and its recommendations presented.

It is unrealistic to expect a perfect decision-making environment regardless of the level of investment in decision-support resources. While improved data, enhanced information and more perfect knowledge may be a worthwhile endeavour; it is their relative contribution to and support of improved SFM decision-making that is the most appropriate indicator of their value in this model.

There may be situations, however, when managers are not cognisant of the support resources available, or when the decision support resources exist, yet are not available to them (depicted by the dashed lines in Figure 2.6.4). In most cases the tactical planning committees have addressed the importance of data, information and knowledge assembly and extension to minimise this occurrence.

A SUSTAINABLE FOREST MANAGEMENT DECISION FRAMEWORK

Figure 2.6.5 presents a conceptual model of the types of decisions common to sustainable forest management. There are six key decision points in this decision framework:



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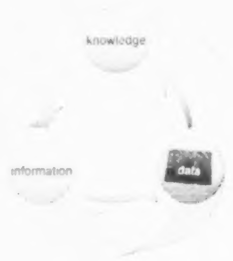

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[illegible] Skyrius, R. 2001. Business decision making, managerial learning and information technology. Univerisity of Vilnius Lithuania. Proceedings of the 2001 Informing Science Conference, Krakow, Poland. June19-22, Cracow University of Economics, Krakow, Poland.

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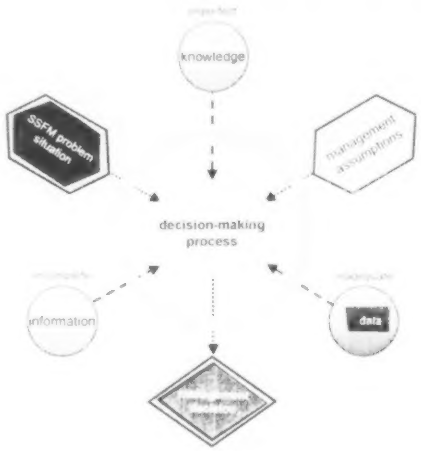
Figure 2.6.4 The imperfect environment of Sustainable Forest Management Decision-making.



Sustainable forest managers usually opt, whenever possible, to use all available decision-support resources as the basis for most important decisions. Rarely, however, are data sets adequate, is information complete, or knowledge perfect. This is the environment within which managers must make decisions, and the circumstances for which this SSFM plan was designed and its recommendations presented.

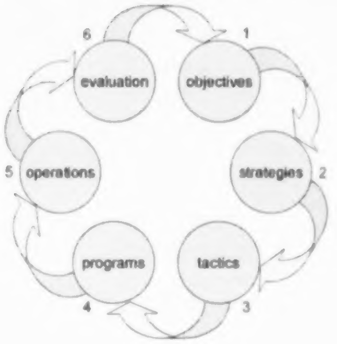
It is unrealistic to expect a perfect decision-making environment regardless of the level of investment in decision-support resources. While improved data, enhanced information and more perfect knowledge may be a worthwhile endeavour; it is their relative contribution to and support of improved SFM decision-making that is the most appropriate indicator of their value in this model.

There may be situations, however, when managers are not cognisant of the support resources available, or when the decision support resources exist, yet are not available to them (depicted by the dashed lines in Figure 2.6.4). In most cases the tactical planning committees have addressed the importance of data, information and knowledge assembly and extension to minimise this occurrence.

A SUSTAINABLE FOREST MANAGEMENT DECISION FRAMEWORK

Figure 2.6.5 presents a conceptual model of the types of decisions common to sustainable forest management. There are six key decision points in this decision framework:

Figure 2.6.5 A sustainable forest management decision framework.[26]



Objective-seeking Decisions

Sustainable forest management objectives must be clearly expressed in measurable terms. This requires decisions of what desired products, resources and services, amenities and uses are required from a specific forest, watershed or landscape area, as well as decisions regarding the specifications of quantity, quality and timing of resource supply. Collectively these decisions define the sustainable forest management objectives.

Strategy-setting Decisions

Based on defined SFM objectives, issues or problems (i.e. a specific resource supply limitation) are analysed and strategic options for resolving the problem are evaluated. Depending on the structure and dynamics of the forest or aquatic ecosystem, and the supply characteristics of the resource of concern, one or more long-term management strategy is selected to resolve the problem and fulfil the forest management objectives. This analytical process constitutes SMF strategic decision-making.

Tactical Design Decisions

Within the context of the SFM strategy (or strategies), a range of feasible, medium term landscape, or local ecosystem-specific tactics are evaluated, based on biological effectiveness, economic efficiency, and social acceptability. The most appropriate tactics are then selected to implement the SFM strategy. This selection process constitutes SFM tactical decision-making.

Program Management Decisions

Following the design of tactics, implementation decisions must follow. Depending on the nature of the tactic, a short or medium term program, or activity implementation schedule must be designed. Program or activity management decisions concern timing, location and costs associated with each intervention necessary to successfully implement the SFM tactic throughout a management unit (forest, landscape unit or watershed). Program management decision-making is usually vested in a specific management organisation or scientific disciplines responsible for management of the resource.

Project implementation Decisions

Based on the SFM program management plan, and guided by the investment funding available in a given year or period, stand, site or ecosystem-level interventions are implemented in the forest. This is the operational level of decision-making. Successful implementation of a program plan at the project level requires specific operational decisions made in advance (operational planning) as well as a capability for on-site problem solving.

Performance evaluation Decisions

Stand, site and ecosystem-level responses to SFM projects or interventions, as well as watershed, landscape and forest level cumulative effects must be evaluated periodically to determine if SFM objectives are actually being achieved. Actual responses and effects are compared with planning forecasts and projections to assess the performance of interventions, activities, programs, tactics and strategies. Depending on actual performance, revisions to plans may be necessary. Sustainable Forest Management values and government policies and direction may also change over time, requiring revision to SFM objectives and all subordinate plans.

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[26] Adapted from Baskerville, G. 1986. Understanding forest management. The Forestry Chronicle, August, 1986 p. 339-347.

Critics of current forest management systems in British Columbia advocate the circular, hierarchical design of this SFM decision model. For example, Wardoyo and Jordan (1996)[27] found that, in contrast, the existing forest management decision system is predominantly linear, employing a decision model with the following characteristics:

- a set of harvest and silvicultural interventions are identified which support an acceptable level of timber production from the forest;
- interventions are gradually implemented, along with pertinent operating regulations and constraints;
- there are no stated forest objectives with which to evaluate stand level response, or forest level effect; and
- little or no forest level performance feedback controls exists, since management is not focused on achieving a specified forest structure or condition.

The decision model proposed here provides a suitable SFM framework and reference for this analysis of decision-support tools in the Omineca-Peace Region. The hierarchical structure, and a circular/iterative design is consistent with adaptive management theory, and compatible with forest certification principles.

SUSTAINABLE FOREST MANAGEMENT DECISION SUPPORT SYSTEMS AND TOOLS

Forest resource managers at all levels of authority rely on their own personal experience and the assimilation of a wide range of data, information and knowledge in day-to-day decision-making. Management decisions are usually required to resolve problems ranging from poorly structured[28] to semi-structured

Although the expression "decision support tool" refers here to the narrow context of SSFM, its meaning is often used interchangeably with "decision support system", which is defined in the larger, more general field of information science:

"Decision Support Systems are interactive, computer-based systems intended to help decision-makers use data and models to identify and solve problems and make decisions."[29]

However, resource managers resolve problems using a wider range of decision-supporting media than this definition encompasses, including:

- databases and spreadsheets containing a wide range of resource data variables;

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[27] Wardoyo, W. and G.A. Jordan. 1996. Measuring and assessing management of forested landscapes. The Forestry Chronicle Vol. 72, No. 6. P. 639-645.

[28] Standard or repetitive decisions situations for which solution techniques are already available (also sometimes called routine or programmed decisions). The structural elements in the situation, e.g. alternatives, criteria, environmental conditions, are known, defined and understood. Unstructured decisions are complex and no standard solutions exist for resolving them. Some or all of the structural elements of the decision situation are undefined, ill-defined or unknown. For example, goals may be poorly defined, alternatives may be incomplete or non-comparable, choice criteria may be hard to measure or difficult to link to goals.

[29] Power, D. J. "What is a DSS?" DSTAR, The On-Line Executive Journal for Data-Intensive Decision Support, October 21, 1997: Vol. 1, No. 3.

- paper documents (research reports, technical guidelines, policies, operating procedures and dichotomous keys and decision-trees);
- group and interpersonal exchanges (expert consultation, technical workshops, technical training); and
- computer-based tools (local or web-based databases and spreadsheets, simulation and optimisation models, computer-based expert systems).

According to Turban (1990)[30], a DSS has four major characteristics:

- DSS incorporate both data and models;
- they are designed to assist managers in their decision processes in semi-structured (or unstructured) tasks;
- they support, rather than replace, managerial judgement; and
- their objective is to improve the effectiveness of the decisions, not the efficiency with which decisions are being made.

Decision support science has evolved rapidly since 1990. There are at least four categories of decision support tools that have relevance to sustainable forest management decision-making. Powers (2001)[31] describes model-driven, knowledge-driven, document-driven and data-driven decision support systems, which are

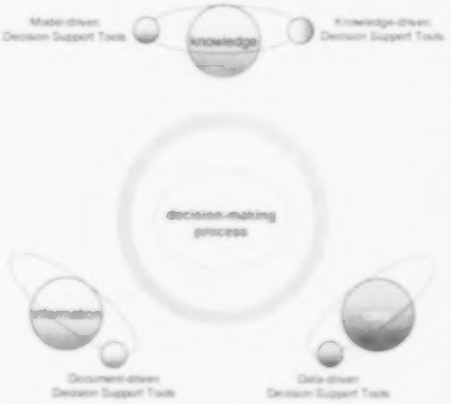

Figure 2.6.6 Decision support tools linked with the three elements of decision support.

Consistent with the elements of decision support discussed previously. Figure 2.6.6 depicts these types of decision tools as 4 "moons" orbiting their respective decision support elements in the SFM decision system.

The following definitions are derived or adapted from Power, 1999.[32]

Data-Driven Decision Support Tools

Data is a binary (digital) representation of atomic facts, text, graphics, bit-mapped images, sound, analog or digital live-video segments. Data is the raw material of a system supplied by data producers and is used by resource managers (information consumers) to create information. The concept of a data warehouse (see Issue 7) derives from this definition. A data warehouse is a database designed to support decision-making in organisations. Data warehouses contain large amounts of data that is usually batch updated and structured for rapid online queries and managerial summaries.. A data warehouse is a subject-oriented, integrated, time-variant, non-volatile collection of data supporting a specific management decision-making process.

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[30] In: Power, D. J. Decision Support Systems Glossary. DSS Resources, World Wide Web, http://DSSResources.COM/glossary/, 1999

[31] Power, D. J., 2001. Supporting decision-makers: an expanded framework. University of Northern Iowa, USA. Univerisity of Vilnius, Lithuania. Proceedings of the 2001 Informing Science Conference, Krakow, Poland. June19-22. Cracow University of Economics, Krakow, Poland.

[32] Power, D. J. *Decision Support Systems Glossary.* DSS Resources, World Wide Web, http://DSSResources.COM/glossary/, 1999

Table 2.6.1 lists those knowledge strategies that specifically cite data-driven decision-support tools as an output. They are further classified by the dominant decision support they provide.

Table 2.6.1 Potential Contribution of Strategic Knowledge Investments to Data-driven SSFM Decision Support (shading indicates positive contribution).

Issue	Strategy	Tactic	Objective-seeking Decisions	Strategy-Setting Decisions	Tactical Design Decisions	Program Management Decisions	Project Implementation Decisions	Performance Evaluation Decisions
1	Vegetation Resources Inventory	1-3	▨	▨	▨			
1	Recreation Features Inventory	1	▨	▨	▨	▨	▨	
1	Ecosystem Mapping	2	▨	▨	▨		▨	
2	Regional Caribou Population Inventory	1,2	▨	▨	▨	▨		
3	Species at Risk - High Sens./Little Known	1-3	▨	▨				
3	Species at Risk - High Sens./Impert. Known	1,2	▨	▨	▨	▨	▨	▨
3	Species at Risk - Mod Sens./Impert. Known	1-7	▨	▨	▨	▨	▨	▨
3	Species at Risk - Low Sens./Impert. Known	1, 3-12	▨	▨	▨			
4	Wildlife Species Knowledge	2,3	▨	▨	▨	▨	▨	▨
4	Wildlife Habitat Mapping	1	▨	▨	▨	▨	▨	▨
5	Natural Disturbance Benchmarks	1,2	▨	▨	▨	▨	▨	
6	Watershed Sensitivity Analysis	1	▨	▨	▨	▨	▨	
6	Remote Sensing Decision Support	1			▨	▨	▨	
7	Regional Fisheries Info. Management	1,2	▨	▨	▨	▨	▨	
7	Fish and Fish Habitat Inventory and Mapping	1	▨	▨	▨	▨	▨	
8	Mixedwood Yield Prediction	1-3	▨	▨	▨			
9	Management of Bark Beetles	1-4		▨	▨	▨	▨	
9	Management of Hard Pine Stem Rusts	1,2	▨	▨	▨			▨
11	Regional Strategic Planning	5	▨	▨	▨			
11	Stand Level Management	3			▨	▨	▨	
12	Short Term Visual Landscape Inventory	1,2	▨	▨	▨	▨	▨	
12	Medium Term Visual Landscape Inventory	1,2	▨	▨	▨	▨	▨	
13	Maint.& Remeas. of Reg. G/Y Plot Network	1	▨	▨	▨	▨	▨	▨

Document-Driven Decision Support Tools

Document-driven decision support tools integrate a variety of presentation, storage and processing technologies to provide complete document retrieval for decision-makers. Hard copy reports (literature reviews, interim and final research reports, policy, procedure and protocol documents, resource management guidelines) are the usual form of document-driven decision support.

The Internet provides user access to a large document base, but often requires custom design of a retrieval system for specific scientific and technical disciplines to ensure efficient access. Electronic document-based decision support systems can also incorporate databases of hypertext documents, images, sounds and video. A search engine is a powerful enhancement of a document-driven decision support system.

For convenience, workshops, demonstrations, speeches and similar face-to-face knowledge exchanges are also included in this category. Most of these extension events are based on document-driven decision tools, or generate their own documentation. Table 2.6.2 lists those knowledge investment strategies that specifically cite document-driven decision-support tools as an output.

Table 2.6.2 Potential Contribution of Strategic Knowledge Investments to Document-driven SSFM Decision Support (dark shading indicates positive contribution; light shading indicates a weaker contribution[33]).

Issue	Strategy	Tactic	Objective-seeking Decisions	Strategy-Setting Decisions	Tactical Design Decisions	Program Management Decisions	Project Implementation Decisions	Performance Evaluation Decisions
1	Ecosystem Mapping	3				░	░	
2	Caribou Habitat Supply Modelling	2				░	░	
2	Human Disturbance Impacts	1-4		▨	▨			
3	Species at Risk - High Sens./Little Known	1-3						
3	Species at Risk - High Sens./Impert. Known	1,2						
3	Species at Risk - Mod Sens./Impert. Known	1-4	▨	▨	▨	▨	▨	▨
3	Species at Risk - Mod Sens./Impert. Known	5-7						
3	Species at Risk - Low Sens./Impert. Known	1, 8, 11						
3	Species at Risk - Low Sens./Impert. Known	2-7, 9,10, 12	▨	▨	▨			
4	Wildlife Species Knowledge	1,2,3						
4	Wildlife Management	1	▨	▨	▨	░	░	▨
5	Natural Disturbance Benchmarks	1-3	▨	▨	▨			
5	Disturbance Features Research	1	▨	▨	▨			
5	Disturbance Features Research	1-3	▨	▨	▨			
7	Regional Fisheries Info Management	1,2	▨	▨	▨	▨	▨	
7	Aquatic Systems Ecology	1,2						
7	Aquatic and Riparian Ecosystem Mngmt	1,2	▨	▨	▨	▨	▨	▨

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[33] Additional costs and further consideration may be required to increase the document-driven decision support utility of these tactics, activities and projects.

8	Management of Mixedwoods	1-3	▨	▨	▨			
8	Mixedwood Yield Prediction	2	▨	▨	▨	▨	▨	
8	Mixedwood Knowledge Extension	1	▨	▨	▨	▨	▨	
9	Management of Bark Beetles	1-4		▨	▨	▨	▨	
9	Management of Hard Pine Stem Rusts	1,3		▨	▨			▨
9	Management of Budworm	1		▨	▨			
9	Management of White Pine Weevil	1		▨	▨			
9	Pest Management Extension	1	▨	▨	▨	▨	▨	▨
10	Alternative Harvesting Extension	1-2	▨	▨	▨			
10	Alternative Harvesting Pilot Studies	1-2			▨	▨	▨	
11	Regional Strategic Planning	1-4	▨	▨	▨			
11	Higher Level Planning	1		▨	▨			
11	Landscape Level Planning	1			▨	▨		
	Forest Development Planning	1-2			▨	▨	▨	
11	Stand Level Management	1-3				▨	▨	
13	Site Productivity Estimation	1-3			▨	▨	▨	
13	Managed Stand Yield Estimation	1	▨	▨	▨	▨	▨	

Knowledge-Driven Decision Support Tools

Knowledge refers to what one knows and understands. Knowledge may be distinguished as unstructured, structured, explicit or tacit. What we know we know is explicit knowledge. If the knowledge is organised and easy to share then it is called structured knowledge. Knowledge that is unstructured and understood, but not clearly expressed is implicit knowledge. To convert implicit knowledge into explicit knowledge, it must be extracted and formatted; a process called knowledge acquisition.

Knowledge acquisition is the extraction and formulation of knowledge derived from various sources, especially from experts in a specific field of forest research or resource management. A collection facts, rules, and procedures in a specific field of interest constitutes a knowledge base.

Knowledge-driven decision-support tools can suggest or recommend actions to managers. These tools may be computerised, or consist of schematic, dichotomous decision-trees; all offer specialised problem-solving expertise to decision-makers. The "expertise" they provide decision-makers consists of knowledge about a particular domain, understanding of problems within that domain, and "skill" at solving specific, related problems. Risk management systems are knowledge-driven decision support tools that have been recently adopted into the domain of sustainable resource management.

Table 2.6.3 lists those knowledge strategies that specifically cite knowledge-driven decision-support tools as an output.

Table 2.6.3 Potential Contribution of Strategic Knowledge Investments to Knowledge-driven SSFM Decision Support (shading indicates positive contribution).

Issue	Strategy	Tactic	Objective-seeking Decisions	Strategy-Setting Decisions	Tactical Design Decisions	Program Management Decisions	Project Implementation Decisions	Performance Evaluation Decisions
1	Ecosystem Mapping[34]	1			▨	▨	▨	
1	Terrain Stability Inventory	1		▨	▨	▨	▨	
2	Caribou Habitat Supply Modelling	3	▨	▨	▨	▨	▨	
3	Species at Risk - High Sens./Imperf. Known[35]	2	▨	▨	▨	▨	▨	
4	Wildlife Species Knowledge[36]	2	▨	▨	▨	▨	▨	
4	Wildlife Habitat Mapping[37]	1	▨	▨	▨	▨	▨	
6	Risk Management [38]Decision Support	1	▨	▨	▨	▨	▨	
7	Fish and Fish Habitat Inventory and Mapping[39]	2	▨	▨	▨	▨	▨	
8	Mixedwood Yield Prediction	1-3	▨	▨	▨			
9	Management of Bark Beetles	2		▨	▨	▨	▨	
9	Management of Hard Pine Stem Rusts	1	▨	▨	▨			▨
9	Management of Budworm	1	▨	▨	▨			
	Management of White Pine Weevil	1	▨	▨	▨			
11	Regional Strategic Planning	2						▨
11	Higher Level Planning			▨	▨	▨		

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[34] PEM is a knowledge-driven, model-based, computer system used to implement the Ecosystem Mapping Strategy. Its contribution is specific to the tactical, program and project decision support of ecosystem mapping and interpretation specialists.

[35] Bull trout habitat prediction model development is a knowledge-driven, model-based, computer system used to implement the bull trout habitat/critical habitat mapping projects. Its contribution is specific to the tactical, program and project decision support of the fish and fish habitat mapping and interpretation specialists.

[36] Pine marten habitat prediction model development is a knowledge-driven, model-based, computer system used to implement the knowledge improvement activity. Its contribution is specific to the tactical, program and project decision support of pine marten specialists.

[37] Habitat prediction modelling is recommended in this strategy for a range of species and habitat types. See footnotes for other species above.

[38] Risk management decision model development is recommended generally, for up to 12 management decision applications (to be determined).

[39] [39] Fish habitat prediction model development is a knowledge-driven, model-based, computer system used to implement the Regional Fish and Fish Habitat Inventories (Tactic 1). See also bull trout habitat/critical habitat prediction model.

Model-Driven Decision Support Tools

Model-driven decision support tools involve decision-maker access to and manipulation of a computer-based model. The most common applications of this category of decision support are forest estate models that project future timber, habitat or other forest values at a landscape or forest level over a long time period. Projection models are useful for exploring management decision scenarios, potential stand or ecosystem interventions, or alternative assumptions of future environmental conditions. In general, model-driven decision support tools employ complex simulation, optimisation, financial and/or rule (expert system) models. They are usually designed to use data and parameters provided by decision-makers to aid in analysing a problem or option, but they are not usually data intensive. The exception to this is conventional forest estate models that require very large vegetation resource inventory datasets, and skilled programming analysts.

Table 2.6.4 lists those knowledge strategies that specifically cite model-driven decision-support tools as an output.

Table 2.6.4 Potential Contribution of Strategic Knowledge Investments to Model-driven SSFM Decision Support (shading indicates positive contribution).

Issue	Strategy	Tactic	Objective-seeking Decisions	Strategy-Setting Decisions	Tactical Design Decisions	Program Management Decisions	Project Implementation Decisions	Performance Evaluation Decisions
2	Caribou Habitat Supply Modelling	1-3	▨	▨	▨	▨	▨	
3	Species at Risk - Mod. Sens./Impert. Known[40]	2	▨	▨	▨	▨	▨	
6	Tree Growth and Stand & Forest Dynamics Dec. Supp	1,2	▨	▨	▨			
8	Management of Mixedwoods	3	▨	▨	▨			
9	Management of Hard Pine Stem Rusts	2		▨	▨			
13	Site Productivity Estimates	3					▨	
13	Managed Stand Yield Estimation	1	▨	▨	▨			

As indicated in the previous analysis, the largest contribution of the recommended knowledge investments is in document-driven decision supports aids, followed by data-driven tools. Relatively few investments address the need for knowledge or model-driven decision tools.

Ultimately, the best balance of knowledge investments is at the discretion of the investor. All recommendations in this report have been thoroughly considered and all are justifiable within their respective issue. Figure 2.6.7 summarises the overall goal of sustainable forest management knowledge enhancement, that is, to place the appropriate tools in the hands of decision-makers.

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[40] Activity 4 of the Wolverine Knowledge Tactic recommends development of a wolverine food/habitat supply projection model.

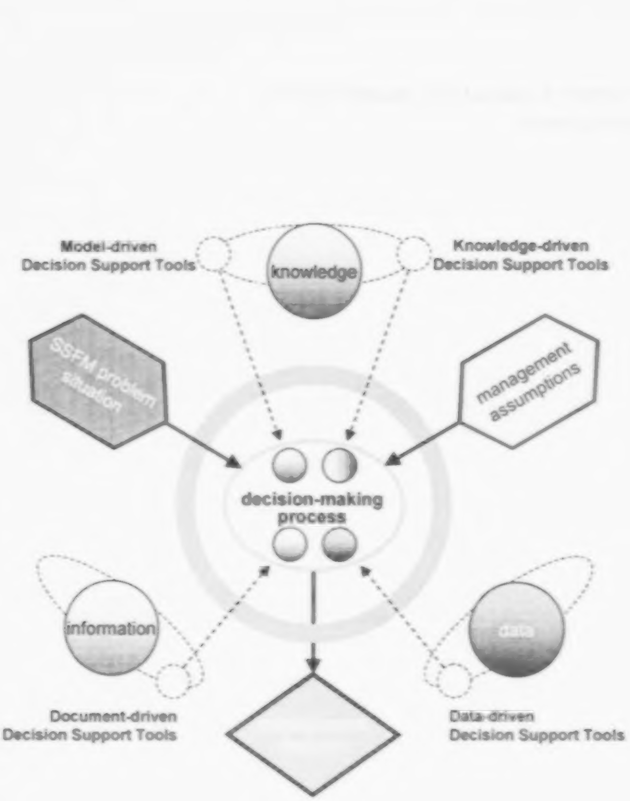
Model-driven
Decision Support Tools
knowledge
Knowledge-driven
Decision Support Tools
SSFM problem situation
management assumptions
decision-making process
information
data
Document-driven
Decision Support Tools
Data-driven
Decision Support Tools

Figure 2.6.7 **Appropriate knowledge investments will place the most needed decision support tools in hands of SFM decision-makers.**

A detailed description of the specific recommendations of the Issue 6 Tactical Planning Team are presented in Section 3. In addition to advocating full implementation of many of the recommendations made in other issue solutions, five distinct decision support strategies were recommended in the areas of watershed management, risk management, decision support, tree, stand and forest dynamics, community sustainable forest management decision support, and remote sensing. Table 2.6.1 presents a detailed cost schedule of these investment recommendations.

Table 2.6.1 **Decision Support Investment Summary.**

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. WATERSHED MANAGEMENT DECISION SUPPORT	1) WATERSHED SENSITIVITY ANALYSIS		1	2500000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Recommended Watershed Management Decision Support Investments			**2500000**	500000	500000	500000	500000	500000
2. RISK MANAGEMENT DECISION SUPPORT	1) RISK MANAGEMENT MODEL DEVELOPMENT		2	960000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Recommended Risk Management Decision Support Investments			**960000**	320000	160000	160000	160000	160000
3. TREE, STAND AND FOREST DYNAMICS DECISION SUPPORT	1) TREE GROWTH & STAND AND FOREST DYNAMICS DECSION SUPPORT – PROBLEM ANALYSIS		3	350000	[illegible]				
	2) TREE GROWTH & STAND AND FOREST DYNAMICS MODEL DEVELOPMENT		4	1000000		[illegible]	[illegible]	[illegible]	[illegible]

					Investment by Period ($/year)				
Recommended Tree Growth & Stand and Forest Decision Support Investments				1350000	35000	250000	250000	250000	250000
4. COMMUNITY SFM DECISION SUPPORT	1) COMMUNITY SUSTAINABLE FOREST MANAGEMENT COMMUNICATION		5	1250000	250000	250000	250000	250000	250000
Recommended Community SFM Decision Support Investments				**1250000**	250000	250000	250000	250000	250000
5. REMOTE SENSING DECISION SUPPORT	1) REMOTE SENSING RESEARCH AND DEVELOPMENT		6	700000	200000	200000	100000	100000	100000
Recommended Medium Term Visual Landscape Inventory Strategic Knowledge Investments				**700000**	200000	200000	100000	100000	100000
Total Recommended Decision Support Investment				**$5445000**	1305000	1380000	1260000	1260000	1260000

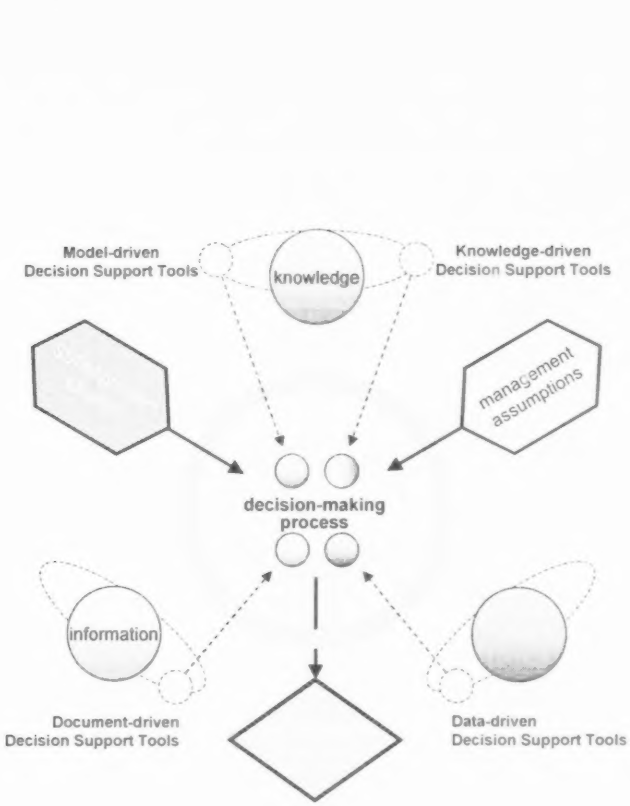
Model-driven Decision Support Tools
knowledge
Knowledge-driven Decision Support Tools
management assumptions
decision-making process
information
Document-driven Decision Support Tools
Data-driven Decision Support Tools

Figure 2.6.7 **Appropriate knowledge investments will place the most needed decision support tools in hands of SFM decision-makers.**

A detailed description of the specific recommendations of the Issue 6 Tactical Planning Team are presented in Section 3. In addition to advocating full implementation of many of the recommendations made in other issue solutions, five distinct decision support strategies were recommended in the areas of watershed management, risk management, decision support, tree, stand and forest dynamics, community sustainable forest management decision support, and remote sensing. Table 2.6.1 presents a detailed cost schedule of these investment recommendations.

Table 2.6.1 Decision Support Investment Summary.

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. WATERSHED MANAGEMENT DECISION SUPPORT	1) WATERSHED SENSITIVITY ANALYSIS		1	2500000	▨	▨	▨	▨	▨
	Recommended Watershed Management Decision Support Investments			**2500000**	500000	500000	500000	500000	500000
2. RISK MANAGEMENT DECISION SUPPORT	1) RISK MANAGEMENT MODEL DEVELOPMENT		2	960000	▨	▨	▨	▨	▨
	Recommended Risk Management Decision Support Investments			**960000**	320000	160000	160000	160000	160000
3. TREE, STAND AND FOREST DYNAMICS DECISION SUPPORT	1) TREE GROWTH & STAND AND FOREST DYNAMICS DECSION SUPPORT – PROBLEM ANALYSIS		3	350000	▨				
	2) TREE GROWTH & STAND AND FOREST DYNAMICS MODEL DEVELOPMENT		4	1000000		▨	▨	▨	▨

					Investment by Period ($/year)				
Recommended Tree Growth & Stand and Forest Decision Support Investments				1350000	35000	250000	250000	250000	250000
4. COMMUNITY SFM DECISION SUPPORT	1) COMMUNITY SUSTAINABLE FOREST MANAGEMENT COMMUNICATION		5	1250000					
Recommended Community SFM Decision Support Investments				**1250000**	250000	250000	250000	250000	250000
5. REMOTE SENSING DECISION SUPPORT	1) REMOTE SENSING RESEARCH AND DEVELOPMENT		6	700000					
Recommended Medium Term Visual Landscape Inventory Strategic Knowledge Investments				**700000**	200000	200000	100000	100000	100000
Total Recommended Decision Support Investment				**$6445000**	1305000	1360000	1260000	1260000	1260000

ISSUE 7 INADEQUATE FISH AND FISH HABITAT MANAGEMENT OBJECTIVES

In the Omineca-Peace Region large areas of the land base lack fisheries information and much of the existing information is under-utilised by stakeholders. These are significant constraints to the development of both strategic and operational resource planning. Improving the reliability, completeness and consolidation of fish information will increase the clarity the ability to establish clear and measure of objectives for sustainable fisheries management today and enable the monitoring and adaptation of the management objectives in the future.

RECOMMENDED FISH AND FISH HABITAT KNOWLEDGE SOLUTION

General populations of fish and fish habitat are potentially at risk from human activities that affect their habitat (i.e. access, food supply, water quality etc.). Increased fisheries knowledge will help decision-makers conserve biological diversity and facilitate the achievement of forest certification by licensees. More complete knowledge of fish forestry interactions and aquatic ecosystem dynamics will give us the information to manage more effectively across the variety of ecosystems in the region.

To this end, an integrated, multiple knowledge solution involving four key strategies is recommended. These strategies, depicted in Figure 2.7.1, address information management, fish and fish habitat inventory and mapping initiatives, aquatic ecosystem research, and water quality management. A full technical description of the strategies comprising this knowledge solution is found in Section 3.

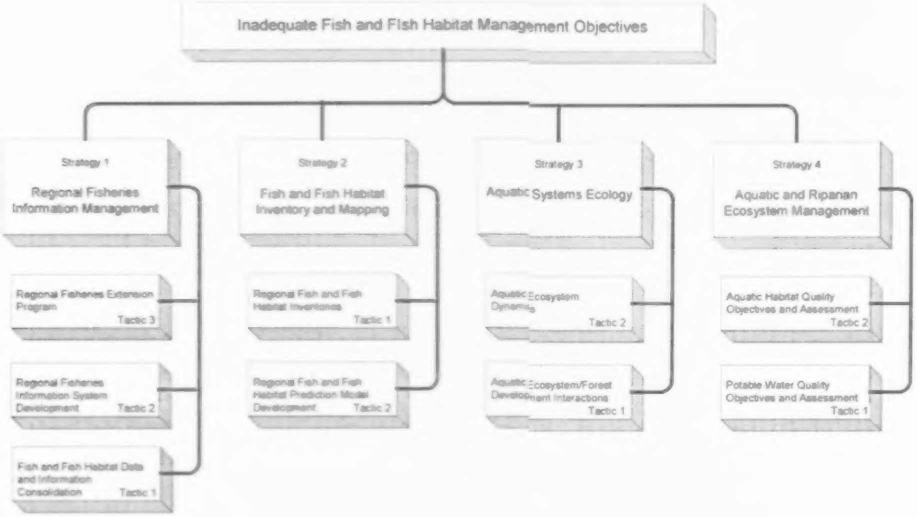
Inadequate Fish and Fish Habitat Management Objectives
Strategy 1
Regional Fisheries Information Management
Strategy 2
Fish and Fish Habitat Inventory and Mapping
Strategy 3
Aquatic Systems Ecology
Strategy 4
Aquatic and Riparian Ecosystem Management
Regional Fisheries Extension Program Tactic 3
Regional Fisheries Information System Development Tactic 2
Fish and Fish Habitat Data and Information Consolidation Tactic 1
Regional Fish and Fish Habitat Inventories Tactic 1
Regional Fish and Fish Habitat Prediction Model Development Tactic 2
Aquatic Ecosystem Dynamics Tactic 2
Aquatic Ecosystem/Forest Development Interactions Tactic 1
Aquatic Habitat Quality Objectives and Assessment Tactic 2
Potable Water Quality Objectives and Assessment Tactic 1

Figure 2.7.1 **Design of the Fish and Fish Habitat Management Knowledge Solution**

STRATEGY 1. REGIONAL FISHERIES INFORMATION MANAGEMENT

This strategy should be implemented via three complimentary knowledge tactics which, collectively, address:

- an immediate need for a state of knowledge assembly of fisheries knowledge for the Omineca-Peace Forest Region;
- design and development of an efficient effective and flexible, client focussed fisheries information system to house all existing data and information, as well as new information investments from related knowledge strategies; and
- design and implementation of a comprehensive fisheries extension program, utilising a range of potential media, all focussed at maximising the utility of existing fisheries information and knowledge.

STRATEGY 2.FISH AND FISH HABITAT INVENTORY AND MAPPING

Reconnaissance fish and fish habitat inventory is available for <30% of the Omineca-Peace; there are still large areas to be addressed. Overview (1:50 000 scale) inventories have been completed in 8 watersheds in the Peace and 1 watershed in the Omineca, but there are additional areas in the northern part of the region where overview inventory is needed to provide basic fisheries information and direct priority setting for future work.

Species population and habitat inventories are required across the range of aquatic ecosystems throughout the region in order to generate the life history information necessary for management decision support.

In view of this overall demand for information, this strategy and its two integral knowledge tactics are recommended for broad scale implementation. Together, they address the following key knowledge requirements:

- collection of new, empirical data via reconnaissance and detailed inventory sampling; and
- development of new (or refinement of existing) fish habitat prediction models.
- Combined, these tactics will provide the most accurate and cost effective means to complete the large inventory task across the region.

STRATEGY 3.AQUATIC SYSTEMS ECOLOGY

One of the key underpinnings of sustainable forest management is an understanding and an anticipation of the potential for environmental impacts from forestry activities on other forest dependant resources. Currently, our understanding of the interactions between forest development activities and fish and fish habitat is incomplete, thus limiting our ability to fully evaluate and mitigate impacts where they might occur.

This knowledge strategy is recommended as a means to explore the relationships between the terrestrial and aquatic environments, as well as enhance our understanding of the structure, function and dynamics of aquatic habitat. Two tactics, each consisting of two research and development projects, are proposed to address this knowledge gap. Both tactics constitute a logical, scientific investigation based on sound problem analysis and client assisted research design process.

STRATEGY 4.AQUATIC AND RIPARIAN ECOSYSTEM MANAGEMENT

The potential impacts of forest harvesting activities on water quality and freshwater biota are generally well known within the resource management community. Lack of crucial decision support, however frustrates our ability to control water quality in forested watersheds. Specifically, an objective means to assess water quality parameter.

This strategy, via two key tactics, is recommended to resolve this problem. It will facilitate concise water quality management objectives, and provide an effective assessment methodology and water sampling protocol. Both tactics will enable direct analysis of the effects of sedimentation, and other impacts on both potable water quality, and aquatic habitat quality.

Table 2.7.1 presents a detailed schedule of the recommended tactics and projects.

Table 2.7.1 Fish and Fish Management Knowledge Solution Summary Table

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. FISHERIES INFORMATION MANAGEMENT	1) DATA AND INFORMATION CONSOLIDATION		1	180000					
	2) REGIONAL FISHERIES INFORMATION SYSTEM		2	350000					
	3) REGIONAL FISHERIES EXTENSION PROGRAM		3	275000					
Recommended Fisheries Information Management Strategic Knowledge Investments				**805000**	250000	210000	115000	115000	115000
2. FISH AND FISH HABITAT INVENTORY AND MAPPING	1) REGIONAL FISH AND FISH HABITAT INVENTORIES		1	5750000					
	2) HABITAT PREDICTION MODEL DEVELOPMENT		4	1340000					
Recommended Fish and Fish Habitat Inventory and Mapping Strategic Knowledge Investments				**7090000**	1550000	1550000	1550000	1240000	1200000
3. AQUATIC SYSTEMS ECOLOGY	1) AQUATIC ECOSYSTEM / FOREST DEVELOPMENT INTERACTIONS	i) Problem Analysis and Experimental Plan	5	50000					
		ii) Aquatic Ecosystem/Forest Development Research	3	**1600000**					
	2) AQUATIC ECOSYSTEM DYNAMICS	i) Problem Analysis and Experimental Plan	5	50000					
		ii) Aquatic Ecosystems Research Project		**1600000**					
Recommended Aquatic Ecosystem Interactions Strategic Knowledge Investments				**3300000**	100000	800000	800000	800000	800000
4. AQUATIC AND RIPARIAN ECO-MANAGEMENT	POTABLE WATER QUALITY MANAGEMENT OBJECTIVES		4	450000					
	AQUATIC HABITAT QUALITY OBJECTIVES AND ASSESSMENT		4	1400000					
Recommended Aquatic and Riparian Ecological Management Strategic Knowledge Investments				**1850000**	250000	400000	400000	400000	400000
Total Recommended Fish and Fish Habitat Management Knowledge Solution Investments				**$3700000**	500000	800000	800000	800000	800000

Figure 2.7.2 depicts the simple interactions and linkages within and between the three strategies making up the knowledge solution.

This strategy, via two key tactics, is recommended to resolve this problem. It will facilitate concise water quality management objectives, and provide an effective assessment methodology and water sampling protocol. Both tactics will enable direct analysis of the effects of sedimentation, and other impacts on both potable water quality, and aquatic habitat quality.

Table 2.7.1 presents a detailed schedule of the recommended tactics and projects.

Table 2.7.1 Fish and Fish Management Knowledge Solution Summary Table

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. FISHERIES INFORMATION MANAGEMENT	1) DATA AND INFORMATION CONSOLIDATION		1	180000	75000	60000	15000	15000	15000
	2) REGIONAL FISHERIES INFORMATION SYSTEM		2	350000	100000	100000	50000	50000	50000
	3) REGIONAL FISHERIES EXTENSION PROGRAM		3	275000	75000	50000	50000	50000	50000
Recommended Fisheries Information Management Strategic Knowledge Investments				**805000**	**250000**	**210000**	**115000**	**115000**	**115000**
2. FISH AND FISH HABITAT INVENTORY AND MAPPING	1) REGIONAL FISH AND FISH HABITAT INVENTORIES		1	5750000	1250000	1250000	1250000	1000000	1000000
	2) HABITAT PREDICTION MODEL DEVELOPMENT		4	1340000	300000	300000	300000	240000	200000
Recommended Fish and Fish Habitat Inventory and Mapping Strategic Knowledge Investments				**7090000**	**1550000**	**1550000**	**1550000**	**1240000**	**1200000**
3. AQUATIC SYSTEMS ECOLOGY	1) AQUATIC ECOSYSTEM / FOREST DEVELOPMENT INTERACTIONS	i) Problem Analysis and Experimental Plan	5	50000	50000				
		ii) Aquatic Ecosystem/Forest Development Research	3	**1600000**		400000	400000	400000	400000
	2) AQUATIC ECOSYSTEM DYNAMICS	i) Problem Analysis and Experimental Plan	5	50000	50000				
		ii) Aquatic Ecosystems Research Project		**1600000**		400000	400000	400000	400000
Recommended Aquatic Ecosystem Interactions Strategic Knowledge Investments				**3300000**	**100000**	**800000**	**800000**	**800000**	**800000**
4. AQUATIC AND RIPARIAN ECO-MANAGEMENT	POTABLE WATER QUALITY MANAGEMENT OBJECTIVES		4	450000	50000	100000	100000	100000	100000
	AQUATIC HABITAT QUALITY OBJECTIVES AND ASSESSMENT		4	1400000	200000	300000	300000	300000	300000
Recommended Aquatic and Riparian Ecological Management Strategic Knowledge Investments				**1850000**	**250000**	**400000**	**400000**	**400000**	**400000**
Total Recommended Fish and Fish Habitat Management Knowledge Solution Investments				**$3700000**	**500000**	**800000**	**800000**	**800000**	**800000**

Figure 2.7.2 depicts the simple interactions and linkages within and between the three strategies making up the knowledge solution.

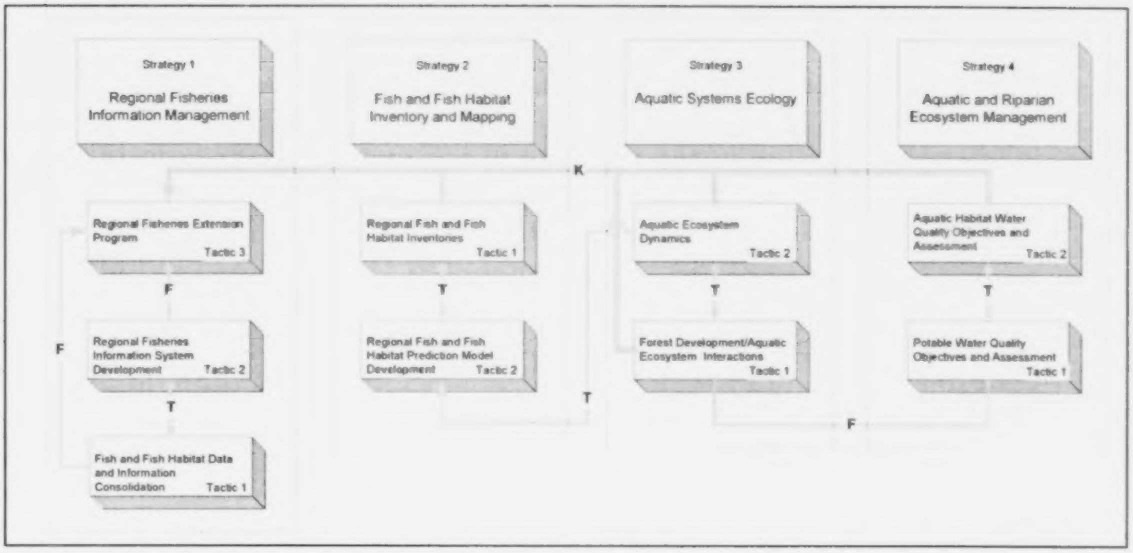
Strategy 1
Regional Fisheries Information Management
Strategy 2
Fish and Fish Habitat Inventory and Mapping
Strategy 3
Aquatic Systems Ecology
Strategy 4
Aquatic and Riparian Ecosystem Management
K
Regional Fisheries Extension Program
Tactic 3
Regional Fish and Fish Habitat Inventories
Tactic 1
Aquatic Ecosystem Dynamics
Tactic 2
Aquatic Habitat Water Quality Objectives and Assessment
Tactic 2
F
T
T
T
F
Regional Fisheries Information System Development
Tactic 2
Regional Fish and Fish Habitat Prediction Model Development
Tactic 2
Forest Development/Aquatic Ecosystem Interactions
Tactic 1
Potable Water Quality Objectives and Assessment
Tactic 1
T
T
F
Fish and Fish Habitat Data and Information Consolidation
Tactic 1

Figure 2.7.2 Interactions and linkages within the Fish and Fish Habitat Knowledge Solution

ISSUE 8 INCOMPLETE UNDERSTANDING OF BOREAL MIXEDWOOD STAND DYNAMICS AND MANAGEMENT OBJECTIVES

Without a thorough understanding of the inter-specific dynamics of conifer-broadleaf mixtures (predominantly white spruce/trembling aspen, interior spruce/aspen, or interior spruce/birch), accurate, reliable and meaningful simulation and projection of stand and forest dynamics is not possible throughout much of the northern third of the region (Boreal White and Black Spruce Zone) (BWBS), and parts of the Sub-Boreal Spruce (SBS) and Interior Cedar Hemlock (ICH) Zones. Sustainable forest management depends on sufficient representation of forest ecosystem and landscape patterns and functions, and the utility, quality and scope of information used in forest analysis. These, in turn, depend on the available knowledge and experience in interpreting the forest analysis, and the accuracy with which stand and landscape responses can be simulated and subsequently predicted.

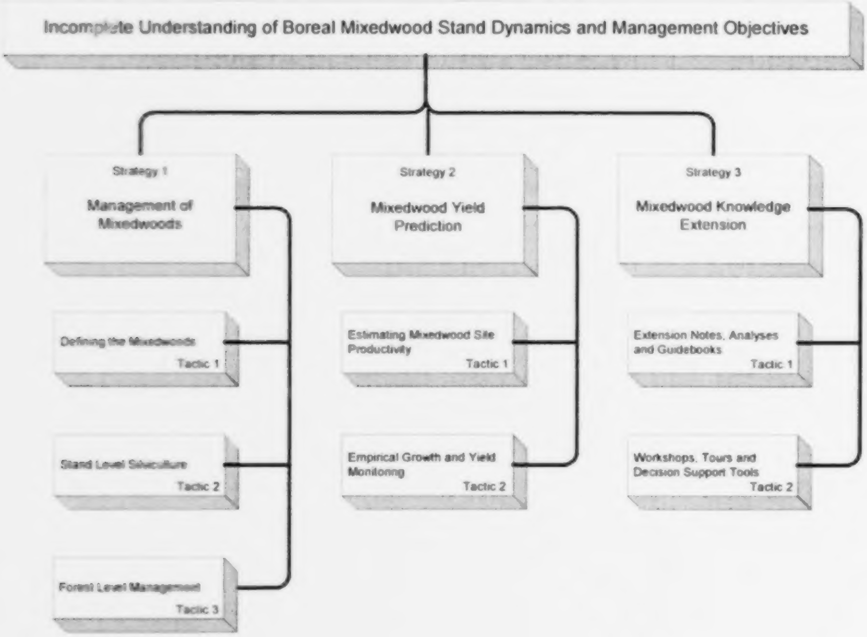
Incomplete Understanding of Boreal Mixedwood Stand Dynamics and Management Objectives
Strategy 1
Management of Mixedwoods
Strategy 2
Mixedwood Yield Prediction
Strategy 3
Mixedwood Knowledge Extension
Defining the Mixedwoods
Tactic 1
Stand Level Silviculture
Tactic 2
Forest Level Management
Tactic 3
Estimating Mixedwood Site Productivity
Tactic 1
Empirical Growth and Yield Monitoring
Tactic 2
Extension Notes, Analyses and Guidebooks
Tactic 1
Workshops, Tours and Decision Support Tools
Tactic 2

Figure 2.8.1 **Design of the Boreal Mixedwood Management Knowledge Solution.**

RECOMMENDED BOREAL MIXEDWOOD KNOWLEDGE SOLUTION

A three-strategy solution to the mixedwood issue is recommended, as depicted in Figure 2.8.1. The first strategy is a key element of the solution: it is designed to improve the level of scientific and technical knowledge concerning the stand and forest level management of stratified and intimate species mixtures in the Boreal and Sub Boreal biogeoclimatic zones of the region. The second strategy comprised several initiatives designed to quantify the actual and potential productivity of mixedwoods, in support of management interpretations. Finally, strategy three addresses the considerable base of existing knowledge concerning mixedwood management, and is designed to improve the level and effectiveness of extension efforts.

- A full technical description of each of these mixedwood knowledge strategies is found in Section 3.

STRATEGY 1.MANAGEMENT OF MIXEDWOODS

Traditional forest management favours simple stand structures that produce large and predictable yields of conifer timber. The increasing focus on biological diversity and ecological processes has stimulated interest in retaining mixedwood forests, yet existing policies, practices and information bases do not adequately support mixedwood management regimes.

Tactic 1: Defining the Mixedwoods

At the heart of the issue is the absence of a clear, concise, working definition of mixedwood sites, stands and forests. Tactic 1 of this strategy addresses this important definition. The recommended approach is based on biological, structural and successional criteria.

Tactic 2: Stand Level Silviculture

Tactic 2 addresses the design of ecologically sound, stand level, mixedwood management regimes. There are a number of potential stand level silvicultural pathways for mixedwood management. Better information is needed to support silvicultural strategy selection and implementation. There are two 'categories' of stand-level information needs:

- those associated with early stand development and stand tending decisions, and
- those associated with residual stand development after harvesting.

Greater emphasis on the broadleaf component of mixedwood stands also demands that the broadleaf gene resource be carefully managed. Western paper birch and trembling aspen require a program of genetic conservation, selection and management, including initiatives such as broadleaf provenance trials, gene research and archives are required.

Five specific research and development projects are recommended as key components to this knowledge tactic.

Tactic 3: Forest Level Management

Tactic 3 addresses gaps in forest level management knowledge, including the implications to economics and biodiversity. Two cornerstone projects are recommended:

- development/refinement of forest supply models suitable for mixedwood management; and
- design and pilot an adaptive management framework for sustainable mixedwood management.

STRATEGY 2.MIXEDWOOD YIELD PREDICTION

Prediction of future forest growth and productivity is a fundamental planning tool. Existing growth and yield information for the tree species and species mixtures found in the BWBS, SBS and ICH is inadequate. This strategy, via three related tactics, is designed to:

- provide a suitable indicator of site productivity potential for stands comprising mixtures of species;
- support the development of suitable tree and stand growth and yield prediction models, and forest level projection models; and
- explore the long-term implications of management practices on mixedwood site productivity potential.

Tactic 1: Estimating Mixedwood Site Productivity

There are several questions related to the definition of site productivity. How is site index (SI) assigned, and is it (reasonably) accurate? How is SI for secondary and tertiary species incorporated into analyses? What are the associated impacts on growth and yield curves? There is a pressing need for more stem analysis to be undertaken.

There is also a need for:

- a measure of site productivity which is based on SI by species, stand type, site conditions, and proportionate stand mixture;
- a better understanding of what the short-term and long-term implications are for this measure; and
- enhanced information on broadleaf site index, its relationship to site series and its relationship to the site index of associated conifers.

This tactic addresses these knowledge gaps via several initiatives, including a focussed inventory of sites series mapping, completion of SIBEC and SIBEC translation to associate mixedwood site index, and completion of VRI phase 3 for mixedwood strata.

Tactic 2: Prediction of Growth and Yield for Stratified Mixtures

There is uncertainty with regard to future stand development in stratified mixedwoods in which partial harvesting has taken place. A single research and development project is recommended that will address:

- the long-term growth response of the species present
- the development or improvement of predictive models for growth and yield in these situations; and
- determine the implications for the TSR, and for other resource values, over multiple rotations in Fort Nelson mixedwood stands.

Tactic 3: Empirical Growth and Yield Monitoring

Models are needed to predict future stand volume, species composition, structure, long-term sustainability, succession and tree senescence, and to link to landscape or forest-level models. There is a need to evaluate all models available and to prioritise their utility and data requirements before proceeding with calibration and testing. All potential model types require empirical stand growth data, which is utilised in initial model calibration, as well as in later verification of model performance.

Potentially suitable growth and yield models are in early stages of development for the complex, multi-species, multi-cohort structures of SBS and BWBS mixedwood stands. Reliable empirical data sets representing the growth and development of a wide range of mixedwood stand types and ages is required to facilitate the design of new models.

This tactic is designed to provide the data required for mixedwood growth and yield model development, through a combination of:

- long-term PSPs with repeated measurements;
- VRI (Phase II) sample plots;
- long-term growth monitoring plots; and
- representation of all mixedwood stand types.

A stand sample plot matrix will be developed to determine which stand types, ecosystems, variants, subzones require representation, and at what intensity plot sampling will be undertaken.

STRATEGY 3:MIXEDWOOD KNOWLEDGE EXTENSION

Some mixedwood management extension activities have been undertaken over the past ten years but mainly on an ***ad hoc*** basis. Thus, there has been little planning and co-ordination for these activities. There has also been no established continuing education and training objectives for mixedwood managers and management programs. Most of the extension activities have centred around field trips/tours and workshops. The current decision support tools for mixedwood management in northeastern BC require updating.

- The third mixedwood knowledge strategy will ensure development and implementation of a comprehensive and well designed extension program designed to make the most effective use of existing and new knowledge. Two integrated knowledge extension tactics are recommended which will ensure that the extensive existing knowledge base important advances resulting from other recommended strategies are brought to the end-user client in a timely and appropriate manner.

- Table 2.8.1 provides a detailed schedule of costs for all strategies and tactics recommended for this knowledge solution.

Table 2.8.1 Boreal Mixedwood Management Knowledge Solution Investment Summary.

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. MANAGEMENT OF MIXEDWOODS	1) DEFINING THE MIXEDWOODS		1	60000	▨	▨			
	2) STAND LEVEL SILVICULTURE	i) Gene Research of Aspen	2	139500	▨	▨	▨	▨	▨
		ii) Gene Research of Birch	2	145000	▨	▨	▨	▨	▨
		iii) Birch Regeneration in SBS Mixedwoods	3	120000	▨	▨	▨	▨	▨
		iv) Mixedwood Stand Health Research	3	257000	▨	▨	▨		
	3) FOREST LEVEL MANAGEMENT DECISION SUPPORT	i) Mixedwood Forest Model Development	1	250000	▨	▨	▨		
		ii) Boreal Sustainable Forest Management Planning	1	975000	▨	▨	▨	▨	▨
Recommended Management of Mixedwoods Strategic Knowledge Investments				**1946500**	401500	488000	460000	305500	291500
2. MIXEDWOOD YIELD PREDICTION	1) ESTIMATING MIXEDWOOD SITE PRODUCTIVITY		1	250000	▨	▨	▨	▨	▨
	2) GROWTH AND YIELD OF STRATIFIED MIXTURES		2	80000	▨	▨	▨	▨	▨
	3) EMPIRICAL GROWTH ANDYIELD MONITORING		2	150000	▨	▨	▨		
Recommended Mixedwood Yield Prediction Strategic Knowledge Investments				**480000**	110000	110000	130000	65000	65000
3. MIXEDWOOD EXTENSION	1) EXTENSION NOTES, ANALYSES AND GUIDEBOOKS		1	959000	▨	▨	▨	▨	▨
	2) WORKSHOPS, TOURS AND DECISION SUPPORT TOOLS		2	945000	▨	▨	▨	▨	▨
Recommended Mixedwood Extension Strategic Knowledge Investments				**1904000**	485000	544000	460000	250000	165000
Total Recommended Boreal Mixedwood Management Knowledge Solution Investment				**$3808000**	970000	1088000	920000	500000	330000

A stand sample plot matrix will be developed to determine which stand types, ecosystems, variants, subzones require representation, and at what intensity plot sampling will be undertaken.

STRATEGY 3:MIXEDWOOD KNOWLEDGE EXTENSION

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					02/03	03/04	04/05	05/06	06/07
1. MANAGEMENT OF MIXEDWOODS	1) DEFINING THE MIXEDWOODS		1	60000	30000	30000			
	2) STAND LEVEL SILVICULTURE	i) Gene Research of Aspen	2	139500	15000	25000	32000	25000	40000
		ii) Gene Research of Birch	2	145000	25000	25000	20000	50000	25000
		iii) Birch Regeneration in SBS Mixedwoods	3	120000	15000	25000	20000	40000	20000
		iv) Mixedwood Stand Health Research	3	257000	91000	83000	83000		
	3) FOREST LEVEL MANAGEMENT DECISION SUPPORT	i) Mixedwood Forest Model Development	1	250000	50000	100000	100000		
		ii) Boreal Sustainable Forest Management Planning	1	975000	175000	200000	200000	200000	200000
Recommended Management of Mixedwoods Strategic Knowledge Investments				**1946500**	401500	448000	460000	365000	291500
2. MIXEDWOOD YIELD PREDICTION	1) ESTIMATING MIXEDWOOD SITE PRODUCTIVITY		1	250000	50000	50000	50000	50000	50000
	2) GROWTH AND YIELD OF STRATIFIED MIXTURES		2	80000	10000	10000	30000	15000	15000
	3) EMPIRICAL GROWTH ANDYIELD MONITORING		2	150000	50000	50000	50000		
Recommended Mixedwood Yield Prediction Strategic Knowledge Investments				**480000**	110000	110000	130000	65000	65000
3. MIXEDWOOD EXTENSION	1) EXTENSION NOTES, ANALYSES AND GUIDEBOOKS		1	959000	270000	279000	165000	165000	80000
	2) WORKSHOPS, TOURS AND DECISION SUPPORT TOOLS		2	945000	215000	265000	295000	85000	105000
Recommended Mixedwood Extension Strategic Knowledge Investments				**1904000**	485000	544000	460000	250000	165000
Total Recommended Boreal Mixedwood Management Knowledge Solution Investment				**$3808000**	970000	1088000	920000	500000	330000

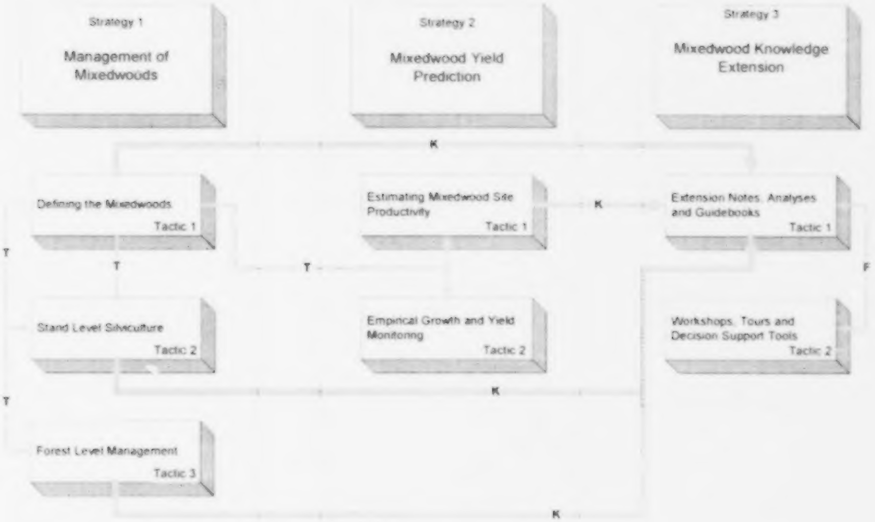

Strategy 1
Management of Mixedwoods
Strategy 2
Mixedwood Yield Prediction
Strategy 3
Mixedwood Knowledge Extension
K
Defining the Mixedwoods
Tactic 1
Estimating Mixedwood Site Productivity
Tactic 1
K
Extension Notes, Analyses and Guidebooks
Tactic 1
T
T
T
F
Stand Level Silviculture
Tactic 2
Empirical Growth and Yield Monitoring
Tactic 2
Workshops, Tours and Decision Support Tools
Tactic 2
K
T
Forest Level Management
Tactic 3
K

Figure 2.8.2 **Interactions and Linkages with the Boreal Mixedwood Management Knowledge Solution.**

ISSUE 9 LACK OF SPECIFIC PEST MANAGEMENT DECISION SUPPORT TOOLS

The forests of central and northern BC are ageing. Since wildfire as a disturbance agent has effectively been removed from these forest landscapes, insects have assumed the dominant role as agents of natural disturbance. Climate change may also be contributing to the very rapid increase in forest pests, and this pattern is likely to increase, not diminish, in the foreseeable future. In the Prince George, Robson Valley, Mackenzie and Quesnel Timber Supply Areas (TSAs), much (75-85%) of the annual harvesting program is determined by insect (pine, spruce, Douglas-fir and balsam bark beetles, and 2-year budworm) infestations. Some Forest Districts (e.g., Vanderhoof) and forest companies (Plateau Forest Products Ltd., Slocan Group) are attempting to direct their entire annual harvest to insect-killed timber.

Mountain pine beetle (MPB) has reached epidemic proportions in seven Forest Districts in central BC (Vanderhoof, Lakes, Morice, Quesnel, Horsefly, Williams Lake, and Fort St. James), with approximately six million hectares and 50 million cubic metres of timber affected. The spruce bark beetle (SB) is nearly epidemic in three districts (Fort St. James, Prince George and Mackenzie), and the western balsam bark beetle (WBBB) is increasing in the Fort St. James, Mackenzie and Robson Valley Forest Districts.

In addition to mature and old forest infestation, root rot fungi (Tomentosus, Annosus, Laminated Root Rot, and Rhizina Root Rot) are also a concern, not only because of their natural occurrence and distribution, but also because of management practices which may facilitate the spread of these diseases. Regenerating stands are affected by pests, e.g., weevils (white pine weevil, lodgepole pine weevil, and Warren's collar weevil), and lodgepole pine stem rusts (western gall rust, comandra blister rust, and stalactiform blister rust).

Overall forest health in the central interior may therefore depend on decision quality and timeliness in dealing effectively with immediate threats to our current timber inventory, as well as how to deal with potential threats to future timber values.

The following information and knowledge is required immediately to address this pest management decision support issue:

- greater understanding of the role that natural disturbance plays in shaping the structure of the forest and forest landscapes;
- more information and knowledge of the ecology, population dynamics and successional dynamics of forest insects and diseases;
- better use of existing knowledge and experience, particularly applied to the development of pest management decision-support tools;
- solutions to current and future forest health/pest management issues are long-term, and involve decisions and actions impacting all forest resources, and all phases of forest management; and
- solutions to current and future forest health/pest management issues must also consider the socio-economic impacts on forest-resource-dependent communities, and must be integrated with long-term community economic development plans.

RECOMMENDED PEST MANAGEMENT DECISION SUPPORT SOLUTION

A muti-strategy solution to this issue is recommended, as depicted in Figure 2.9.1. Decision support strategies are defined for four groups of forest pests considered to be most serious:

- bark beetles;

- hard pine stem rusts;
- 2-year budworm, and
- white pine weevil.

A full technical description of the strategies and tactics is found in Section 3.

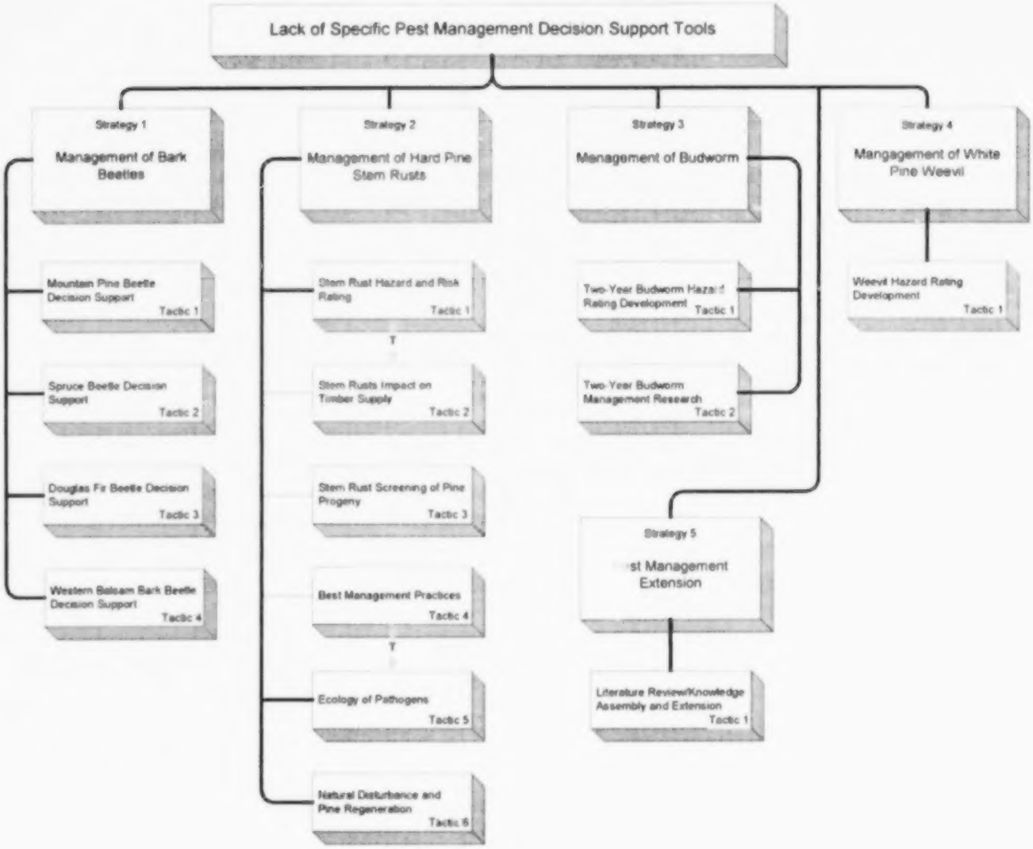

Lack of Specific Pest Management Decision Support Tools
Strategy 1
Management of Bark Beetles
Strategy 2
Management of Hard Pine Stem Rusts
Strategy 3
Management of Budworm
Strategy 4
Mangagement of White Pine Weevil
Mountain Pine Beetle Decision Support Tactic 1
Spruce Beetle Decision Support Tactic 2
Douglas Fir Beetle Decision Support Tactic 3
Western Balsam Bark Beetle Decision Support Tactic 4
Stem Rust Hazard and Risk Rating Tactic 1
Stem Rusts Impact on Timber Supply Tactic 2
Stem Rust Screening of Pine Progeny Tactic 3
Best Management Practices Tactic 4
Ecology of Pathogens Tactic 5
Natural Disturbance and Pine Regeneration Tactic 6
Two-Year Budworm Hazard Rating Development Tactic 1
Two-Year Budworm Management Research Tactic 2
Weevil Hazard Rating Development Tactic 1
Strategy 5
Pest Management Extension
Literature Review/Knowledge Assembly and Extension Tactic 1

Figure 2.9.1 **Design of the Pest Management Decision Support Knowledge Solution.**

STRATEGY 1:MANAGEMENT OF BARK BEETLES

Four specific decision-support tactics are recommended, addressing each of the four species of bark beetle currently affecting timber values and forest dynamics in the Omineca-Peace Region currently:

- Mountain pine beetle;
- Spruce beetle;
- Douglas fir beetle; and

- Western balsam bark beetle.

While tactics and recommended research and development projects vary according to current knowledge of the insect, the approach is similar for each species; knowledge concerning rate of infestation spread and early detection capability is most needed to support management decisions.

STRATEGY 2:MANAGEMENT OF HARD PINE STEM RUSTS

This strategy is designed to consolidate and enhance the state of knowledge concerning this pest, and to directly support lodgepole pine managed stand decision-making. A suite of 6 tactics addressing key knowledge requirements comprise the overall strategy:

Tactic 1: Stem Rust Hazard and Risk Rating

This research and development tactic addresses the possible correlation between ecological site factors and rust incidence, and potential development of a stem rust hazard and risk rating system. The purpose of this initiative is to develop a means for resource managers to anticipate the occurrence of stem rust in managed stands, and recommendations for actions that could eliminate or minimise the impacts on future managed lodgepole stands.

Tactic 2: Stem Rust Impact on Timber Supply

This knowledge tactic explores the impacts of stem rusts to lodgepole pine tree growth (form, vigour, defect) and timber volume and value production in managed pine stands. Knowledge from this initiative will increase the precision of operational adjustment factors applied to lodgepole pine yield curves, thereby improving the biological reality of yield projections, and future lodgepole pine timber supply. Two integrated research and development projects are recommended to implement this tactic.

Tactic 3: Progeny Testing for Lodgepole Pine Susceptibility to Infection

An extensive, 30 year old lodgepole pine progeny testing experimental network exists in the Omineca-Peace Region. This network of trials requires on-going evaluation and analysis to determine the potential for genetic screening for hard pine stem rust resistance. The purpose of this initiative is to determine whether sufficient progeny variation in rust resistance exists to warrant stem rust resistance breeding.

Tactic 4: Best Management Practices

This tactic, through an initial problem analysis, addresses the need to identify the most appropriate and effective silvicultural practices to minimise or eliminate significant impacts to the growth and yield of current and future managed lodgepole pine stands.

Tactic 5: Ecology of Pathogens

A considerable knowledge base has been compiled concerning the biology and ecology of hard pine rust species and their hosts. This tactic, through an initial problem analysis seeks to consolidate all existing information and knowledge, and to recommend where additional investigations may be required.

Tactic 6: Natural Disturbance and Pine Regeneration

This tactic initiates, via a problem analysis, research aimed at comparing and contrasting the stem rust incidence, hazard and risk associated with natural versus artificial regeneration of lodgepole pine. This investigation also addresses the relationship between landscape level disturbance factors and the pathogen.

STRATEGY 3:MANAGEMENT OF BUDWORM

The strategy consists of two knowledge tactics designed to support budworm management decisions:

Tactic 1: Two-year Budworm Hazard Rating Development

This tactic is designed to provide an inventory of the historic and current incidence of 2-year budworm infestations to determine effects of stand age, composition and structure (horizontal and vertical) on budworm incidence and severity. The purpose is to determine if there are sufficient relationships between site and ecological factors to warrant development of a hazard and risk rating system.

Tactic 2: Two-year Budworm Management Research

This tactic has multiple objectives: it is designed to re-evaluate first year infestation mapping methods to determine whether early detection of second year attack is feasible; It also addresses the need for greater knowledge of the synecology of the organism to facilitate development of decision support for pest management.

STRATEGY 4:MANAGEMENT OF WHITE PINE WEEVIL

A single tactic is recommended to determine if sufficient correlation exists between infestation frequency and ecological site and stand factors to warrant development of a hazard rating.

STRATEGY 5:PEST MANAGEMENT DECISION SUPPORT EXTENSION

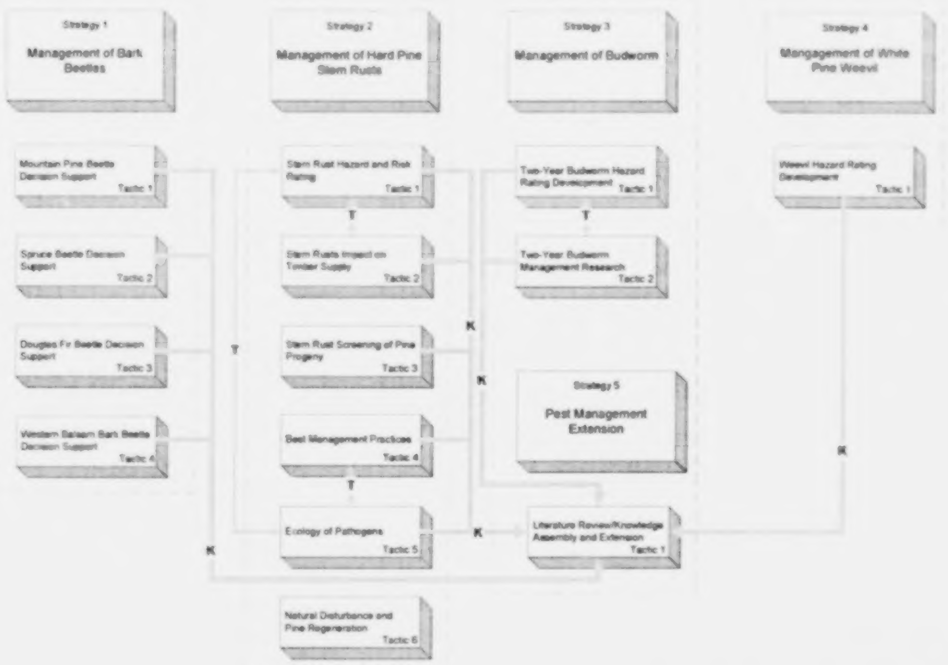
This strategy should be implemented via a single tactic, designed to improve the utility of the extensive, existing knowledge base concerning the four groups of pests in the Omineca-Peace Region. A state of knowledge assembly, and design of an effective electronic and/or hardcopy extension system will ensure clients have better access to pest management decision support data, information and knowledge.

A detailed cost schedule of all strategies and tactics recommended in this solution is presented in Table 2.9.1.

Table 2.9.1 Pest Management Decision Support Knowledge Solution Investment Summary.

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. MANAGEMENT OF BARK BEETLES	1) MOUNTAIN PINE BEETLE DECISION SUPPORT	i) Infestation Rate of Spread Research	1	350000	100000	100000	100000	50000	
		ii) Early Detection Remote Sensing Problem Analysis	1	50000	50000				
		iii) Early Detection Remote Sensing Research	1	500000	200000	200000	50000	50000	
	2) SPRUCE BEETLE DECISION SUPPORT		2	1100000	450000	450000	150000	50000	
	3) DOUGLAS FIR BEETLE DECISION SUPPORT		6	350000	100000	100000	100000	50000	
	4) WESTERN BALSAM BARK BEETLE DECISION SUPPORT		4	290000	80000	80000	80000	50000	
Recommended Management of Bark Beetles Strategic Knowledge Investments				**2640003.91**	980000.67	930000.75	480000.8	250000.83	0.84
2. MANAGEMENT OF HARD	1) STEM RUST HAZARD AND RISK RATING		1	500000	100000	100000	100000	100000	100000
	2) STEM RUSTS IMPACT ON TIMBER SUPPLY	i) Stem Rust Calibration of Growth and Yield Models	2	250000	50000	50000	50000	50000	50000
		ii) Stem Rust Monitoring	2	90000	30000	30000	30000		
	3) PROGENY TESTING - PINE SUSCEPTIBILITY	i) Screening of Pine Progeny	3	90000	30000	30000	30000		
	4) BEST MANAGEMENT PRACTICES	i) Problem Analysis	4	25000					25000

					Investment by Period ($/year)				
	5) ECOLOGY OF PATHOGENS	i) Problem Analysis	7	25000					25000
	6) NATURAL DISTURBANCE AND PINE REGENERATION	i) Problem Analysis	8	25000					25000
Recommended Management of Hard Pine Stem Rusts Strategic Knowledge Investments				**1005000**	210000	210000	210000	100000	275000
3. MANAGEMENT OF BUDWORM	1) TWO-YEAR BUDWORM HAZARD RATING		3	350000	150000	100000	100000		
	2) TWO-YEAR BUDWORM RESEARCH		5	350000	100000	100000	100000	50000	
Recommended Management of Budworm Strategic Knowledge Investments				**700000**	250000	200000	200000	50000	0
4. MANAGEMENT OF WHITE PINE WEEVIL	1) WEEVIL HAZARD RATING		3	300000	100000	100000	100000		
Recommended Management of White Pine Weevil Strategic Knowledge Investments				**300000**	100000	100000	100000	0	0
5. PEST MANAGEMENT EXTENSION	1) LITERATURE REVIEWS, KNOWLEDGE ASSEMBLY & EXTENSION		1	250000	50000	50000	50000	50000	50000
Recommended Pest Management Extension Strategic Knowledge Investments				**250000**	50000	50000	50000	50000	50000
Total Recommended Pest Management Knowledge Solution Investment				**800000**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]


Strategy 1
Management of Bark Beetles
Strategy 2
Management of Hard Pine Stem Rusts
Strategy 3
Management of Budworm
Strategy 4
Mangagement of White Pine Weevil
Mountain Pine Beetle Decision Support
Tactic 1
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Tactic 3
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Stem Rust Hazard and Risk Rating
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Strategy 5
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Figure 2.9.2 Interactions and Linkages within the Pest Management Decision Support Knowledge Solution.

STRATEGY 3:MANAGEMENT OF BUDWORM

The strategy consists of two knowledge tactics designed to support budworm management decisions:

Tactic 1: Two-year Budworm Hazard Rating Development

This tactic is designed to provide an inventory of the historic and current incidence of 2-year budworm infestations to determine effects of stand age, composition and structure (horizontal and vertical) on budworm incidence and severity. The purpose is to determine if there are sufficient relationships between site and ecological factors to warrant development of a hazard and risk rating system.

Tactic 2: Two-year Budworm Management Research

This tactic has multiple objectives: it is designed to re-evaluate first year infestation mapping methods to determine whether early detection of second year attack is feasible. It also addresses the need for greater knowledge of the synecology of the organism to facilitate development of decision support for pest management.

STRATEGY 4:MANAGEMENT OF WHITE PINE WEEVIL

A single tactic is recommended to determine if sufficient correlation exists between infestation frequency and ecological site and stand factors to warrant development of a hazard rating.

STRATEGY 5:PEST MANAGEMENT DECISION SUPPORT EXTENSION

This strategy should be implemented via a single tactic, designed to improve the utility of the extensive, existing knowledge base concerning the four groups of pests in the Omineca-Peace Region. A state of knowledge assembly, and design of an effective electronic and/or hardcopy extension system will ensure clients have better access to pest management decision support data, information and knowledge.

A detailed cost schedule of all strategies and tactics recommended in this solution is presented in Table 2.9.1.

Table 2.9.1 Pest Management Decision Support Knowledge Solution Investment Summary.

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. MANAGEMENT OF BARK BEETLES	1) MOUNTAIN PINE BEETLE DECISION SUPPORT	i) Infestation Rate of Spread Research	1	350000	▨	▨	▨	▨	
		ii) Early Detection Remote Sensing Problem Analysis	1	50000	▨				
		iii) Early Detection Remote Sensing Research	1	500000	▨	▨	▨	▨	
	2) SPRUCE BEETLE DECISION SUPPORT		2	1100000	▨	▨	▨	▨	
	3) DOUGLAS FIR BEETLE DECISION SUPPORT		6	350000	▨	▨	▨	▨	
	4) WESTERN BALSAM BARK BEETLE DECISION SUPPORT		4	290000	▨	▨	▨	▨	
Recommended Management of Bark Beetles Strategic Knowledge Investments				**2640003.91**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2. MANAGEMENT OF HARD	1) STEM RUST HAZARD AND RISK RATING		1	500000	▨	▨	▨	▨	▨
	2) STEM RUSTS IMPACT ON TIMBER SUPPLY	i) Stem Rust Calibration of Growth and Yield Models	2	250000	▨	▨	▨	▨	▨
		ii) Stem Rust Monitoring	2	90000	▨	▨	▨		
	3) PROGENY TESTING - PINE SUSCEPTIBILITY	i) Screening of Pine Progeny	3	90000	▨	▨	▨		
	4) BEST MANAGEMENT PRACTICES	i) Problem Analysis	4	25000					▨

					Investment by Period ($/year)				
	5) ECOLOGY OF PATHOGENS	i) Problem Analysis	7	25000					▨
	6) NATURAL DISTURBANCE AND PINE REGENERATION	i) Problem Analysis	8	25000					▨
Recommended Management of Hard Pine Stem Rusts Strategic Knowledge Investments				**1005000**	210000	210000	210000	150000	225000
3. MANAGEMENT OF BUDWORM	1) TWO-YEAR BUDWORM HAZARD RATING		3	350000	▨	▨	▨		
	2) TWO-YEAR BUDWORM RESEARCH		5	350000	▨	▨	▨	▨	
Recommended Management of Budworm Strategic Knowledge Investments				**700000**	250000	200000	200000	50000	0
4. MANAGEMENT OF WHITE PINE WEEVIL	1) WEEVIL HAZARD RATING		3	300000	▨	▨	▨		
Recommended Management of White Pine Weevil Strategic Knowledge Investments				**300000**	100000	100000	100000	0	0
5. PEST MANAGEMENT EXTENSION	1) LITERATURE REVIEWS, KNOWLEDGE ASSEMBLY & EXTENSION		1	250000	▨	▨	▨	▨	▨
Recommended Pest Management Extension Strategic Knowledge Investments				**250000**	50000	50000	50000	50000	50000
Total Recommended Pest Management Knowledge Solution Investment				**500000**	100000	100000	100000	100000	100000

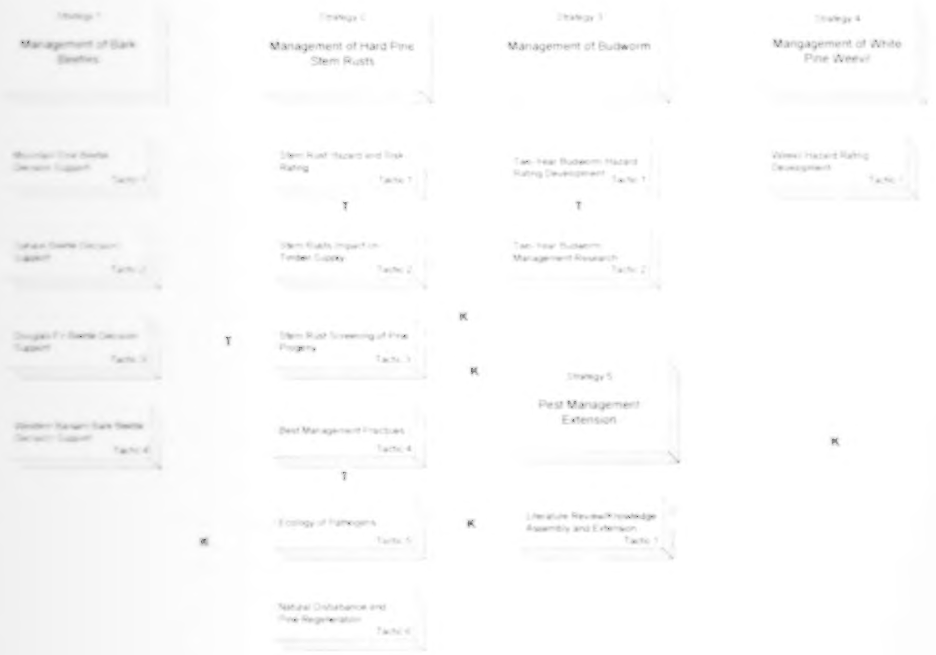

Strategy 1
Management of Bark Beetles
Strategy 2
Management of Hard Pine Stem Rusts
Strategy 3
Management of Budworm
Strategy 4
Mangagement of White Pine Weevil
Mountain Pine Beetle Decision Support
Tactic 1
Stem Rust Hazard and Risk Rating
Tactic 1
Two-Year Budworm Hazard Rating Development
Tactic 1
Weevil Hazard Rating Development
Tactic 1
T
T
Spruce Beetle Decision Support
Tactic 2
Stem Rusts Impact on Timber Supply
Tactic 2
Two-Year Budworm Management Research
Tactic 2
K
Douglas Fir Beetle Decision Support
Tactic 3
T
Stem Rust Screening of Pine Progeny
Tactic 3
K
Strategy 5
Pest Management Extension
Western Balsam Bark Beetle Decision Support
Tactic 4
Best Management Practices
Tactic 4
K
T
Ecology of Pathogens
Tactic 5
K
K
Literature Review/Knowledge Assembly and Extension
Tactic 1
Natural Disturbance and Pine Regeneration
Tactic 6

Figure 2.9.2 **Interactions and Linkages within the Pest Management Decision Support Knowledge Solution.**

ISSUE 10 LACK OF ALTERNATIVE HARVESTING EXPERIENCE

Currently, there is a lack of operational knowledge and experience in the application of alternative harvesting techniques such as partial cutting with cable-yarding systems. This limits the potential these systems might offer in resolving site specific management problems concerning sensitive sites, inoperable stands and multiple resource values sensitive to conventional harvesting methods. Lack of operational experience also precludes a reasonable economic analysis of alternative harvesting methods, a knowledge gap that fosters the view that unconventional methods are always impractical

This regional SSFM issue has been raised to bridge the gap from the unknown to the familiar, and potentially to the proven.

RECOMMENDED ALTERNATIVE HARVESTING KNOWLEDGE SOLUTION

As depicted in Figure 2.10.1, the recommended solution to this issue consists of two, interactive strategies: a knowledge extension initiative, and an experience and knowledge generating initiative.

The extension strategy comprises two tactics. Firstly, all information and knowledge pertinent to the application of alternative harvesting method in the Omineca-Peace Region is assembled and consolidated. This base of information and knowledge is then made available to northern clients via tactic 2, a series of workshops.

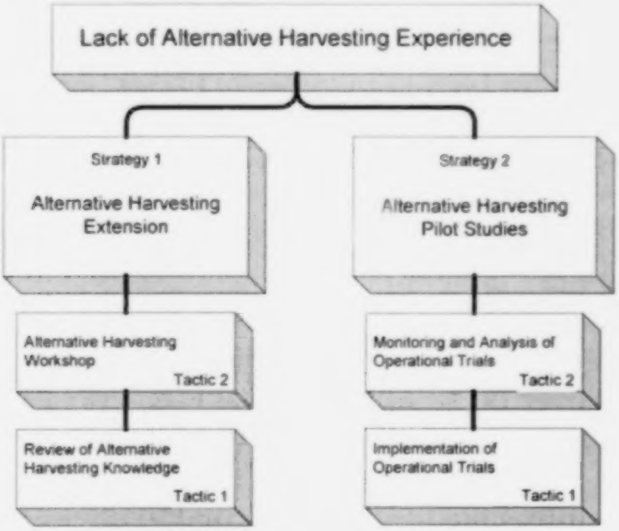

Lack of Alternative Harvesting Experience
Strategy 1
Alternative Harvesting Extension
Strategy 2
Alternative Harvesting Pilot Studies
Alternative Harvesting Workshop
Tactic 2
Monitoring and Analysis of Operational Trials
Tactic 2
Review of Alternative Harvesting Knowledge
Tactic 1
Implementation of Operational Trials
Tactic 1

Figure 2.10.1 Design of the Alternative Harvesting Experience Knowledge Solution.

The Pilot Study Strategy is designed to generate on-the-ground operational experience over the next five years. A program of operational trials (tactic 1) and operational monitoring and analysis (tactic 2) ensure that new knowledge is documented and shared as early as possible.

A full and detailed description of this simple solution is found in Section 3. A detailed cost schedule for this simple solution is presented in Table 2.10.1.

Table 2.10.1 **Alternative Harvesting Experience Knowledge Solution Investment Summary.**

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. ALTERNATIVE HARVESTING EXTENSION	1) REVIEW OF ALTERNATIVE HARVESTING KNOWLEDGE		1	20000	▨				
	2) ALTERNATIVE HARVESTING WORKSHOP		2	160000	▨	▨			
	Recommended Alternative Harvesting Extension Strategic Knowledge Investments			**180000**	60000	120000	0	0	0
2. ALTERNATIVE HARVESTING PILOT STUDIES	1) IMPLEMENTATION OF OPERATIONAL TRIALS		3	2000000	▨	▨	▨	▨	▨
	2) MONITORING, ANALYSIS AND REPORTING OF OPERATIONAL TRIALS	i) Monitoring of Operational Trials	4	80000		▨	▨	▨	▨
		ii) Analysis and Reporting of Operational Trial Results	5	80000		▨	▨	▨	▨
	Recommended Alternative Harvesting Pilot Studies Strategic Knowledge Investments			**2160000**	170000	700000	650000	340000	300000
Total Recommended Alternative Harvesting Knowledge Solution Investments				**$4150000**	170000	1400000	1300000	680000	600000

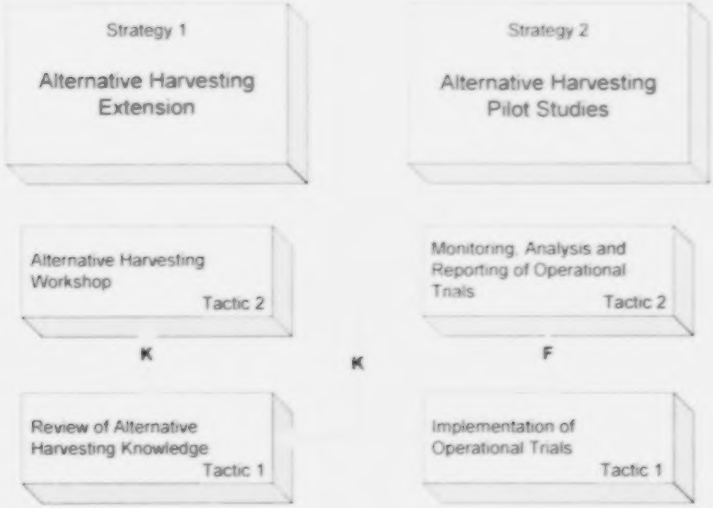

Strategy 1
Alternative Harvesting Extension
Strategy 2
Alternative Harvesting Pilot Studies
Alternative Harvesting Workshop
Tactic 2
Monitoring, Analysis and Reporting of Operational Trials
Tactic 2
K
K
F
Review of Alternative Harvesting Knowledge
Tactic 1
Implementation of Operational Trials
Tactic 1

Figure 2.10.2 **Interactions and Linkages within the Alternative Harvesting Knowledge Solution.**

Table 2.10.1 **Alternative Harvesting Experience Knowledge Solution Investment Summary.**

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. ALTERNATIVE HARVESTING EXTENSION	1) REVIEW OF ALTERNATIVE HARVESTING KNOWLEDGE		1	20000	20000				
	2) ALTERNATIVE HARVESTING WORKSHOP		2	160000	40000	120000			
Recommended Alternative Harvesting Extension Strategic Knowledge Investments				**180000**	60000	120000	0	0	0
2. ALTERNATIVE HARVESTING PILOT STUDIES	1) IMPLEMENTATION OF OPERATIONAL TRIALS		3	2000000	170000	680000	590000	320000	240000
	2) MONITORING, ANALYSIS AND REPORTING OF OPERATIONAL TRIALS	i) Monitoring of Operational Trials	4	80000		10000	30000	10000	30000
		ii) Analysis and Reporting of Operational Trial Results	5	80000		10000	30000	10000	30000
Recommended Alternative Harvesting Pilot Studies Strategic Knowledge Investments				**2160000**	170000	700000	650000	340000	300000
Total Recommended Alternative Harvesting Knowledge Solution Investments				**$4150000**	170000	1400000	1300000	680000	600000

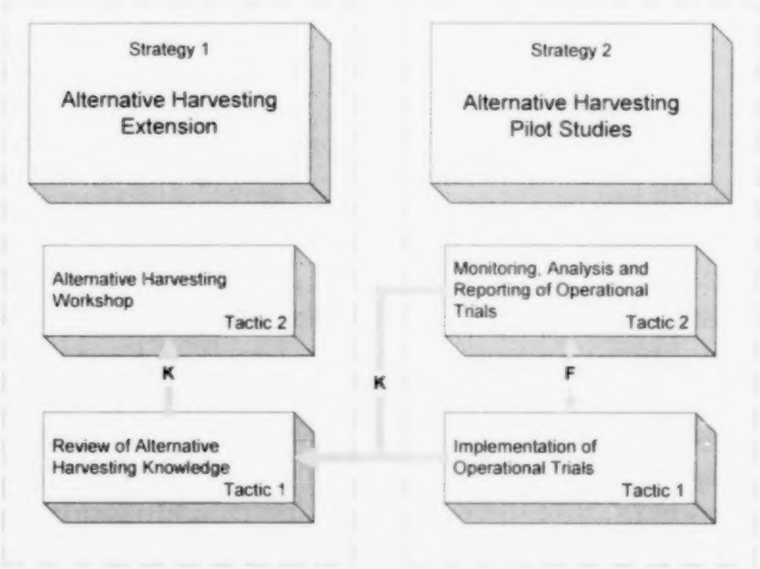

Strategy 1
Alternative Harvesting Extension
Strategy 2
Alternative Harvesting Pilot Studies
Alternative Harvesting Workshop
Tactic 2
Monitoring, Analysis and Reporting of Operational Trials
Tactic 2
K
K
F
Review of Alternative Harvesting Knowledge
Tactic 1
Implementation of Operational Trials
Tactic 1

Figure 2.10.2 **Interactions and Linkages within the Alternative Harvesting Knowledge Solution.**

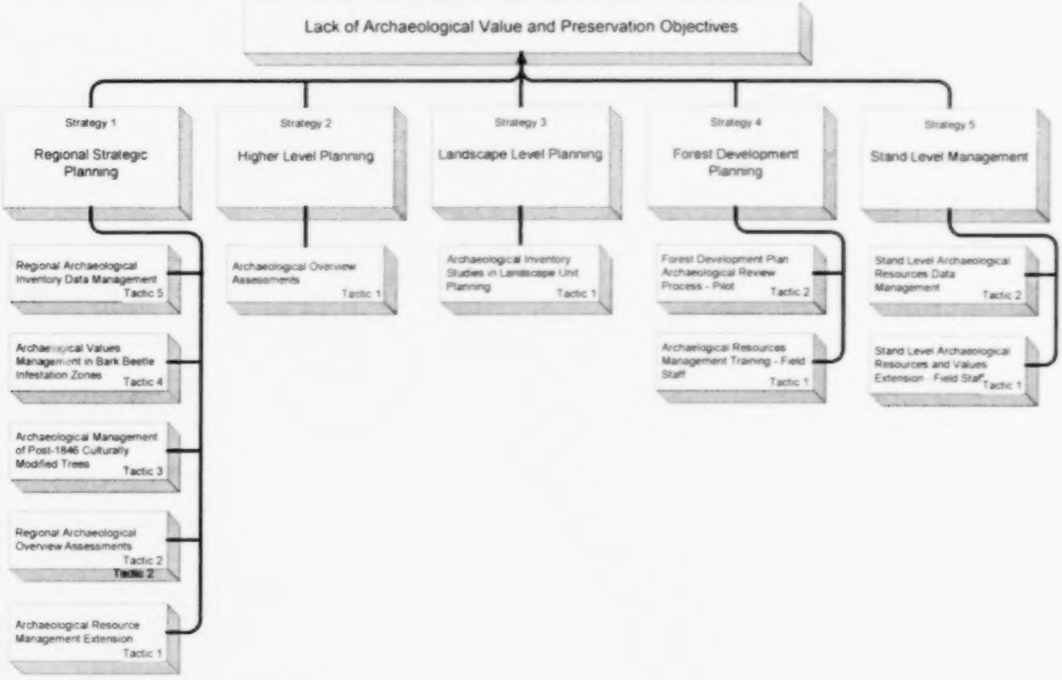
ISSUE 11 LACK OF ARCHEOLOGICAL VALUE AND PRESERVATION OBJECTIVES

Current management tools and objectives for managing archaeological sites for the Region are inadequate. The Ministry of Forests is required by the *HCA* to ensure that impacts to archaeological sites by forest management activities are appropriately managed. In the event that the locations of archaeological sites are not known, the *Forest Practices Code of British Columbia Act* provides for the protection of previously unidentified archaeological resource features which may be located during actual operations (Section 51). If encountered, a licensee must stop any activity that could damage a previously unidentified archaeological resource, and notify the district manager. The licensee is then obliged to apply for an alteration permit and identify methods that are approved by Archaeology Branch, Ministry of Sustainable Resource Management, to mitigate any possible disturbance to archaeological sites.

In the absence of initiatives to improve decision support, archaeological and cultural heritage resources may be at risk, and unexpected work stoppages are likely to continue. Of most concern, this situation can and does cause unnecessary conflict between the forest industry and First Nations groups.

RECOMMENDED ARCHAEOLOGICAL VALUE AND PRESERVATION KNOWLEDGE SOLUTION

As depicted in Figure 2.11.1, the recommended solution appears complex, involving initiatives at five levels of resource management. In reality, however, the overall complexity of the recommended strategies and tactics, and the total cost of resolving this issue is surprisingly low.



Lack of Archaeological Value and Preservation Objectives
Strategy 1
Regional Strategic Planning
Strategy 2
Higher Level Planning
Strategy 3
Landscape Level Planning
Strategy 4
Forest Development Planning
Strategy 5
Stand Level Management
Regional Archaeological Inventory Data Management Tactic 5
Archaeological Values Management in Bark Beetle Infestation Zones Tactic 4
Archaeological Management of Post-1846 Culturally Modified Trees Tactic 3
Regional Archaeological Overview Assessments Tactic 2
Tactic 2
Archaeological Resource Management Extension Tactic 1
Archaeological Overview Assessments Tactic 1
Archaeological Inventory Studies in Landscape Unit Planning Tactic 1
Forest Development Plan Archaeological Review Process - Pilot Tactic 2
Archaelogical Resources Management Training - Field Staff Tactic 1
Stand Level Archaeological Resources Data Management Tactic 2
Stand Level Archaeological Resources and Values Extension - Field Staff Tactic 1

Figure 2.11.1 **Design of the Archaeological Values Knowledge Solution.**

STRATEGY 1:REGIONAL STRATEGIC PLANNING

Overall direction for the management of archaeological resources within a forestry environment is simply an extension of archaeological resource management direction for the province. General goals of archaeological resource management are provided in the *British Columbia Archaeological Resource Management Handbook* and *British Columbia Archaeological Impact Assessment Guidelines.* Strategic planning defines when and how archaeological planning, impact assessment and management studies will take place. This direction provides the framework for all archaeological resource management within the MoF planning framework.

Five related tactics are recommended which address strategic planning knowledge gaps in the Omineca-Peace Region

Tactic 1: Archaeological Resource Management Extension

The overall integration of an archaeological resource management framework within the forest management planning process has not been well articulated. A general introduction to forestry related archaeological resource planning, including source documentation, is required for planners to understand and improve archaeological resource management within each district. In addition to being able to source these documents, planners within government (Ministries of Forests and Sustainable Resource Management) and industry should participate in training/workshops to gain familiarity with the processes and activities.

This knowledge tactic is designed to provide a suitable overview document on archaeological resource management in order to ensure that district planners can utilise available planning support tool to their fullest extent.

Tactic 2: Regional Archaeological Overview Assessments

Archaeological Overview Assessments (AOA) have been completed for over half of the districts in the region. These studies should, however, be reviewed and revised to incorporate additional information and more accurate data sets that have been developed since the studies were first completed. The original terms of reference for developing these studies are not applicable to their revision. Revised terms of reference should be developed.

Management direction within the AOA's has not been standardised. These studies generally divide the landscape into zones of high, moderate high, moderate and low potential. However the definitions of what constitutes high, moderate etc. varies with each study. Thus management direction in adjacent districts may differ for areas of similar archaeological potential. Potential zones should therefore be defined in terms of archaeological site density per km. or other objective measure across the province.

This knowledge tactic addresses the need for revised AOA standards via three related projects: preparation of new AOA standards and procedures; revision of AOA contract specifications; and design of a system for monitoring the effectiveness and accuracy of district AOA's

Tactic 3: Archeological Management of Post 1846 Culturally Modified Trees

Clear direction regarding the management of post 1846 culturally modified tree (CMT) sites is required by forest district resource staff. These sites are not protected by the Heritage Conservation Act. However, decisions regarding the disposition of these sites are a Delgamuukw responsibility, and therefore must involve consultation with First Nations.

The recording and management of post 1846 CMT's is inconsistent across the districts. Regional direction is required to determine how these sites should be recorded and managed.

This tactic addresses the management of post 1846 CMT through two project which clarify the regional policy regarding post 1846 CMT management, and specify regional protocols for surveys and data collection.

Tactic 4: Archaeological Values Management in Bark Beetle Infestation Zones

It is not always possible to complete an archaeological impact assessment (AIA) on a beetle kill area with archaeological potential prior to salvage harvesting. Stand removal can result in destruction of protected archaeological sites resulting in serious legal liability for the operator.

Legal obligations under the Heritage Conservation Act must be balanced against issues of forest health and a resulting strategy developed for the region. This knowledge tactic addresses this problem through definition of a regional policy and survey and data collection protocol.

Tactic 5: Archaeological Inventory Data Management

Effective and efficient archaeological resource planning depends on access to all available planning studies. In the past, spatial information had to be requested from the Archaeology Branch and archaeological resource management studies ordered in hardcopy from the Heritage Resource Centre.

An Archaeological Inventory Data Centre has been created as a self service web site to access all relevant spatial data sets and resource management reports. However, there is insufficient funding to include two important data sets; archaeological impact assessment reports in the "virtual library" and a spatial coverage showing where archaeological resource management studies have taken place. Access to these data sets is vital for informed, effective management decisions.

This data source would be extremely useful if all archaeological reports for the last five years were available online. Standardised electronic submission of all new reports and spatial coverages would also support this data source. Development of these standards should be a contract deliverable.

This tactic seeks to enhance the existing regional archaeological database through the addition of geo-referenced archaeological study data and reports. This initiative will improve decision-support to regional forest resource managers.

STRATEGY 2:HIGHER LEVEL PLANNING

Land and resource management decisions represent the broadest, higher level plans in the provincial planning process. Archaeological resource management within an LRMP encompasses two tasks:

- Development of an AOA as the basic planning tool for the study area (usually corresponding to a forest district); and
- Identification of special management zones to be managed for archaeological resources.

Two related activities include:

- A description of the resource, related legislation and general management direction within the plan; and
- Identification of unprotected heritage sites of provincial or regional significance as candidates for Provincial designation.

A major limitation to higher level archaeological resources management planning is the lack of archaeological expertise needed to successfully apply this knowledge to reviews of forestry operations. AOA implementation at the district level must include seminars and workshops to all individuals who utilise the products of an AOA (primarily the potential maps). Workshop seminars should include basic information regarding the use, strengths and weakness of the district AOA's and mechanisms to monitor and upgrade the archaeological land use models, as new information becomes available.

A single tactic is recommended to address the role AOA's should play in higher level planning. Consisting of three separate, but similar AOA review projects, this tactic will ensure that AOA's (new or revised) within 5 of the eight forest districts in the region meet the higher level planning needs of MoF and industry forest resource managers.

STRATEGY 3:LANDSCAPE LEVEL PLANNING

Archaeological Inventory Studies (AIS) are the key decision support tool at the landscape unit planning stage. The purpose of implementing AIS at this level is threefold:

- to confirm the accuracy of archaeological site location predictions made within the AOA;
- to identify archaeological site locations in areas of special interest or sensitivities; and
- to inventory other heritage features, such as trails.

Another benefit of landscape level inventory is the additional information available for revisions of the AOA.

The Archaeological Management landscape level planning strategy consists of a single knowledge AIS related tactic comprising two projects that:

- Develop regional AIS guidelines;
- Implement a planning workshop for key region and district personnel;
- Recommend revisions to data management procedures that will increase the effectiveness and utility of regional archaeological spatial data and resource management report investments.

STRATEGY 4:FOREST DEVELOPMENT PLANNING

There is insufficient archaeological expertise within the MoF to successfully review the archaeological component of forest development plans. This forest development planning level strategy is recommended as a means to address this applied knowledge deficit via two tactics.

Tactic 1: Archaeological Resource Management Training

The level of local familiarity with archaeological decision-support can be enhanced through workshops for district staff. This tactic is designed to increase the effectiveness of archaeological resource management through a series of district staff training initiatives.

Tactic 2: Forest Development Plan Archaeological Review Process Pilot

While field staff training may be an expedient method to improve planning skills, this tactical pilot is recommended as an accompanying solution. The pilot study should utilise recognised archaeological expertise in local development plan reviews. The purpose of this recommendation is to evaluate and compare the overall efficiency and effectiveness of archaeological resource management planning by employing a staff archaeologist at the forest district level.

STRATEGY 5:STAND LEVEL MANAGEMENT

Archaeological impact studies are required by the District Manager as a condition of permit for identified operations. These operations have the potential to conflict with protected archaeological resources identified during the Forest Development Plan review.

Three types of archaeological studies are common stand level management techniques; Archaeological Impact Assessments (AIA's), Archaeological Impact Management Studies (AIM) and Preliminary Field Reconnaissance (PFR). These studies are defined in Issues description.

This knowledge strategy is designed to improve the effectiveness and efficiency of stand level archaeological management through two tactics that address:

- training of field staff in archaeological site awareness and resource management;
- improving culturally modified tree recording methodology;
- systematic recording of preliminary field reconnaissance (PFR's); and
- storage of results in the Archaeological Inventory Data Centre.

A full technical discussion of all strategies, tactics and projects recommended in this solution are found in Section 3. A detailed cost schedule is presented Table 2.11.1.

Table 2.11.1 **Archaeological Values Knowledge Solution Investment Summary.**

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking[41]	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. REGIONAL STRATEGIC PLANNING	1) ARCHAELOGICAL RESOURCE MANAGEMENT EXTENSION		H 1	25000	25000				
	2) REGION ARCH. OVERVIEW ASSESSMENTS	i) Regional Arch. Overview Assessments Revision	H 2	2500	2500				
		ii) AOA Contacting Standards Revision	H 3	0	0				
		iii) District-wide Archaeological Overview Assessments	H 4	5,000	5000				
	3) MANAGEMENT OF POST 1846 CULTURALLY MODIFIED TREES	i) Regional Policy on Post-1846 CMT Management	H 5	0	0				
		ii) Sampling Protocol for CMT Assessments	H 6	30,00030000	30000				
	4) MANAGEMENT IN BARK BEETLE INFESTATION ZONES	i) Regional Policy on AIA's in MPB Salvage Areas	H 7	0	0				
		ii) Sampling Protocol for AIA's in MPB Salvage Areas	H 8	330000,000	30000				
	5) REGIONAL ARCHAEOLOGICAL DATA MANAGEMENT		H 9	50000	50000				
Recommended Regional Level Archaeological Planning Strategic Knowledge Investments				**143,330,112,50**	**142500**	**0**	**0**	**0**	**0**
2. HIGHER LEVEL PLANNING	1) ARCHAEOLOGICAL OVERVIEW ASSESSMENTS	i) AOA Review – Peace River Districts	H 1	50000	10000	10000	10000	10000	10000
		ii) AOA Review – Mackenzie Forest District	M 1	20000	20000				
		iii) AOA Review – Robson Valley Forest District	M 2	10000	10000				
Recommended Higher Level Archaeological Planning Strategic Knowledge Investments				**80000**	**40000**	**10000**	**10000**	**10000**	**10000**
3. LANDSCAPE LEVEL PLANNING	1) ARCH. INVENTORY STUDIES IN LANDSCAPE LEVEL PLANNING	i) Guidelines for Arch. Studies in Landscape Level Planning	M 1	10000	10000				
		ii) Revision of BC Arch. Studies Guidelines	M 2	2500	2500				
Recommended Landscape Level Archaeological Planning Strategic Knowledge Investments				**12500**	**12500**	**0**	**0**	**0**	**0**

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[41] Priority Ranking for Archaeological Values and Objectives Solution Initiatives: relative priority – **H**-high and **M**-moderate Ranking is relative only within planning level categories (i.e. Strategic Planning priorities, Higher Level Planning priorities etc.)

STRATEGY 5:STAND LEVEL MANAGEMENT

Archaeological impact studies are required by the District Manager as a condition of permit for identified operations. These operations have the potential to conflict with protected archaeological resources identified during the Forest Development Plan review.

Three types of archaeological studies are common stand level management techniques; Archaeological Impact Assessments (AIA's), Archaeological Impact Management Studies (AIM) and Preliminary Field Reconnaissance (PFR). These studies are defined in Issues description.

This knowledge strategy is designed to improve the effectiveness and efficiency of stand level archaeological management through two tactics that address:

- training of field staff in archaeological site awareness and resource management;
- improving culturally modified tree recording methodology;
- systematic recording of preliminary field reconnaissance (PFR's); and
- storage of results in the Archaeological Inventory Data Centre.

A full technical discussion of all strategies, tactics and projects recommended in this solution are found in Section 3. A detailed cost schedule is presented Table 2.11.1.

Table 2.11.1 Archaeological Values Knowledge Solution Investment Summary.

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking[41]	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. REGIONAL STRATEGIC PLANNING	1) ARCHAELOGICAL RESOURCE MANAGEMENT EXTENSION		H 1	25000	▨				
	2) REGION ARCH. OVERVIEW ASSESSMENTS	i) Regional Arch. Overview Assessments Revision	H 2	2500	▨				
		ii) AOA Contacting Standards Revision	H 3	0	▨				
		iii) District-wide Archaeological Overview Assessments	H 4	5.000	▨				
	3) MANAGEMENT OF POST 1846 CULTURALLY MODIFIED TREES	i) Regional Policy on Post-1846 CMT Management	H 5	0	▨				
		ii) Sampling Protocol for CMT Assessments	H 6	30.00030000	▨				
	4) MANAGEMENT IN BARK BEETLE INFESTATION ZONES	i) Regional Policy on AIA's in MPB Salvage Areas	H 7	0	▨				
		ii) Sampling Protocol for AIA's in MPB Salvage Areas	H 8	330000.000	▨				
	5) REGIONAL ARCHAEOLOGICAL DATA MANAGEMENT		H 9	50000	▨				
Recommended Regional Level Archaeological Planning Strategic Knowledge Investments				**143,330,112,50**	**142500**	**0**	**0**	**0**	**0**
2. HIGHER LEVEL PLANNING	1) ARCHAEOLOGICAL OVERVIEW ASSESSMENTS	i) AOA Review – Peace River Districts	H 1	50000	▨	▨	▨	▨	▨
		ii) AOA Review – Mackenzie Forest District	M 1	20000	▨				
		iii) AOA Review – Robson Valley Forest District	M 2	10000	▨				
Recommended Higher Level Archaeological Planning Strategic Knowledge Investments				**80000**	**40000**	**10000**	**10000**	**10000**	**10000**
3. LANDSCAPE LEVEL PLANNING	1) ARCH. INVENTORY STUDIES IN LANDSCAPE LEVEL PLANNING	i) Guidelines for Arch. Studies in Landscape Level Planning	M 1	10000	▨				
		ii) Revision of BC Arch. Studies Guidelines	M 2	2500	▨				
Recommended Landscape Level Archaeological Planning Strategic Knowledge Investments				**12500**	**12500**	**0**	**0**	**0**	**0**

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[41] Priority Ranking for Archaeological Values and Objectives Solution Initiatives: relative priority – **H**-high and **M**-moderate Ranking is relative only within planning level categories (i.e. Strategic Planning priorities, Higher Level Planning priorities etc.)

					Investment by Period ($/year)				
4. FOREST DEVELOPMENT PLANNING	1) ARCH. RES. MANAGEMENT TRAINING – FIELD STAFF		H 1	20000	▨				
	2) FDP REVIEW – PILOT PROJECT		H 2	100000	▨				
Recommended Forest Development Level Archaeological Planning Strategic Knowledge Investments				**120000**	120000				
5. STAND LEVEL MANAGEMENT	1) ARCH. RES. AND VALUES EXTENSION – FIELD STAFF TRAINING		H 1	40000	▨	▨	▨	▨	▨
	2) STAND LEVEL ARCH RESOURCE DATA MANAGEMENT	i) Culturally Modified Tree Recording Methodology	H 2	60000	▨				
		ii) Preliminary Field Reconnaissance Data	H 3	5000	▨				
Recommended Stand Level Archaeological Planning Strategic Knowledge Investments				**105000**	75000	10000	10000	5000	5000
Total Recommended Archaeological Values Knowledge Solution Investment				**$210000**	150000	20000	20000	10000	10000

					Investment by Period ($/year)				
4. FOREST DEVELOPMENT PLANNING	1) ARCH. RES. MANAGEMENT TRAINING – FIELD STAFF		H 1	20000	20000				
	2) FDP REVIEW – PILOT PROJECT		H 2	100000	100000				
Recommended Forest Development Level Archaeological Planning Strategic Knowledge Investments				**120000**	120000				
5. STAND LEVEL MANAGEMENT	1) ARCH. RES. AND VALUES EXTENSION – FIELD STAFF TRAINING		H 1	40000	10000	10000	10000	5000	5000
	2) STAND LEVEL ARCH RESOURCE DATA MANAGEMENT	i) Culturally Modified Tree Recording Methodology	H 2	60000	60000				
		ii) Preliminary Field Reconnaissance Data	H 3	5000	5000				
Recommended Stand Level Archaeological Planning Strategic Knowledge Investments				**105000**	75000	10000	10000	5000	5000
Total Recommended Archaeological Values Knowledge Solution Investment				**$210000**	150000	20000	20000	10000	10000

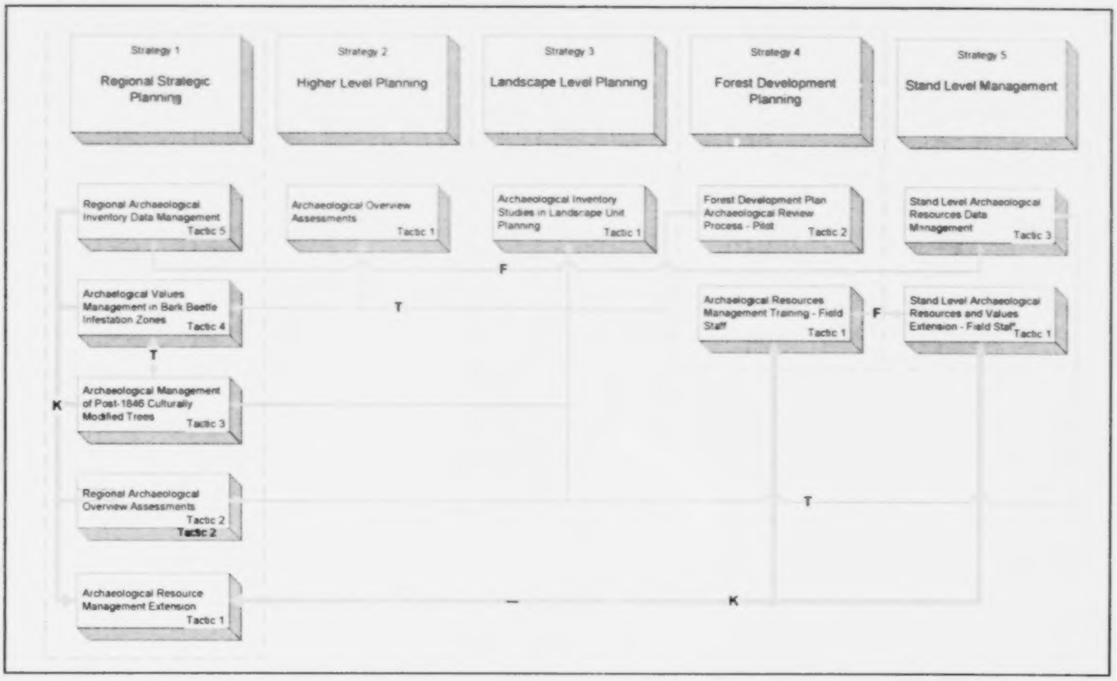

Strategy 1
Regional Strategic Planning
Strategy 2
Higher Level Planning
Strategy 3
Landscape Level Planning
Strategy 4
Forest Development Planning
Strategy 5
Stand Level Management
Regional Archaeological Inventory Data Management Tactic 5
Archaeological Overview Assessments Tactic 1
Archaeological Inventory Studies in Landscape Unit Planning Tactic 1
Forest Development Plan Archaeological Review Process - Pilot Tactic 2
Stand Level Archaeological Resources Data Management Tactic 3
F
Archaeological Values Management in Bark Beetle Infestation Zones Tactic 4
T
Archaeological Resources Management Training - Field Staff Tactic 1
F
Stand Level Archaeological Resources and Values Extension - Field Staff Tactic 1
T
K
Archaeological Management of Post-1846 Culturally Modified Trees Tactic 3
Regional Archaeological Overview Assessments Tactic 2
Tactic 2
T
Archaeological Resource Management Extension Tactic 1
—
K

Figure 2.11.1 **Interactions and Linkages within the Archaeological Values Knowledge Solution.**

ISSUE 12 INCOMPLETE OR OUTDATED VISUAL LANDSCAPE INVENTORIES

The visual resource is one of the legislated forest resources to be managed and conserved in this province and is an integral part of the environmental values considered important by society. Without an adequate knowledge base, there are inherent risks of mismanaging the visual resource by inadequate integration into strategic plans and by creating adverse visual impacts on visually sensitive landscapes. This, in turn, creates uncertainty regarding the maintenance of environmental values and the sustainable use of timber and non-timber resources.

More accurate knowledge is required on the location of all visually sensitive landscapes, what makes them important and how sensitive they are to alteration. Visual landscape inventories (VLI) delineate, classify, and record those areas that are considered visually sensitive and that could give rise to public concern if their appearance were altered by resource development activities. However, knowledge gaps currently exist in the VLI for each Forest District due to out-dated or incomplete coverage.

RECOMMENDED RESOURCE INVENTORIES KNOWLEDGE SOLUTION

As depicted in Figure 2.12.1, the visual resources inventory issue may be resolved by a relatively simple, two-strategy solution. Initially, an immediate, short-term strategy is recommended to address the most urgent requirements. Complete resolution is recommended by the timely implementation of the second, medium term strategy. A full technical discussion of each strategy is found in Section 3.

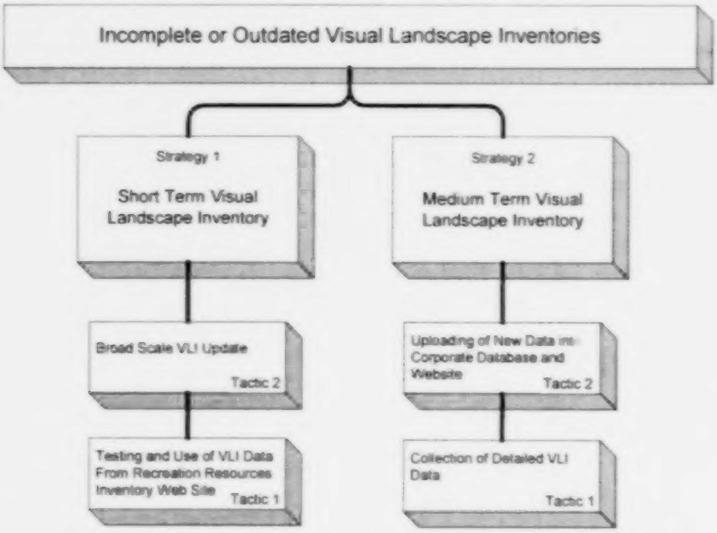

Incomplete or Outdated Visual Landscape Inventories
Strategy 1
Short Term Visual Landscape Inventory
Strategy 2
Medium Term Visual Landscape Inventory
Broad Scale VLI Update
Tactic 2
Uploading of New Data into Corporate Database and Website
Tactic 2
Testing and Use of VLI Data From Recreation Resources Inventory Web Site
Tactic 1
Collection of Detailed VLI Data
Tactic 1

Figure 2.12.1 **Design of the Visual Landscape Inventory Knowledge Solution.**

STRATEGY 1:SHORT-TERM VISUAL LANDSCAPE INVENTORY

Existing and new VLI data must be disseminated in a timely fashion and be easily accessible for a variety of uses and client needs. The Ministry of Sustainable Resource Management supports a provincial Recreation Resources Inventory (RRI) web site, which provides access to all the broad-scale and detailed VLI data that were available in the region two years ago. Since that time local improvements and additions to the broad-scale coverage and database have been undertaken in many districts. The Provincial data "warehouse" therefore requires updating to ensure all known, broad-scale information is available to strategic level decision-makers in the region.

The goals of this short-term strategy are three-fold:

- to evaluate the suitability of this web site to house the new broad scale VLI inventory data available throughout the region;
- to recommend and design enhancements to the site for incorporating future datasets; and
- to prepare a map-base coverage from which the broad-scale inventory update may be implemented.

Two knowledge tactics are recommend to efficiently implement this strategy:

Tactic 1: Testing and Use of VLI Data from Recreation Resources Inventory Web Site

This tactic is designed to evaluate the user convenience, design and features of the Provincial web site, particularly for downloading of VLI graphics and text data. Recommendations will be made for improvement or enhancement of the user-interface, as well as for streamlining the integration of new Omineca-Peace VLI data from Strategies 1 and 2. Customised, 1:250,000 scale VLI maps (featuring including contours, roads, water features, parks, etc.) will also be assembled from the web-based data for use in each forest district. This map base will be utilised during Tactic 2 of this strategy, and for preparations for Strategy 2.

Tactic 2: Broad Scale VLI Inventory Update

Immediate update of the VLI data found in the corporate database is needed for each district. The base maps produced in Tactic 1, combined with any broad or detailed VLI data collected since the initial upload, will be integrated using standards and procedures endorsed by RIC. Recommendations from LRMPs and other planning processes will also be incorporated.

STRATEGY 2:MEDIUM TERM VISUAL LANDSCAPE INVENTORY

This strategy is designed to capture new, detailed visual landscape inventory data over the next five years. All data will be collected, processed and stored to RIC standards and procedures, based on local priorities documented in VLI status reports. This data collection initiative must include request for public input, fieldwork, digitising, data entry, and quality control, reports and photographs.

Two, sequential tactics are recommended to increase the efficiency of this strategy:

Tactic 1: Collection of Detailed VLI Data

Implementation of this tactic is costly; in order to maximise efficiency the portion of the landscape visible from various viewing locations will be indentified. Visually Sensitive Units, or SVU's will then be delineated, thereby replacing the broad-scale units originally mapped in Strategy 1. Each VSU will then be classified in terms of existing visual condition, visual absorption capability, and biophysical and viewing characteristics, resulting in assignment of a visual sensitivity class.

Tactic 2: Uploading of New VLI Data into Corporate Database and Web Site

This tactic completes the visual landscape inventory knowledge solution uploading the newly acquired, detailed VLI data into the provincial database for wide access and distribution. This tactic should be implemented at the end of each fiscal year in keeping with the completion of detailed VLIs and TSR 3 schedule and time frames. No cost is associated with the tactic since it expected that the task would be the responsibility of the Ministry of Sustainable Resource Management.

Table 2.12.1 presents the detailed cost schedule of all strategies and tactics comprising this knowledge solution.

Table 2.12.1 Visual Landscape Inventory Knowledge Solution Investment Summary.

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. SHORT TERM VISUAL LANDSCAPE INVENTORY	1) TESTING AND USE OF VLI FROM REC. RES. INV. WEB	8 Projects (1/forest district)	1	10000	▨				
	2) BROAD SCALE VLI UPDATE	8 Projects (1/forest district)	2	100000	▨				
Recommended Short Term Visual Landscape Inventory Strategic Knowledge Investments				**110000**	110000				
2. MEDIUM TERM VISUAL LANDSCAPE INVENTORY	1) COLLECTION OF DETAILED VISUAL LANDSCAPE	8 Projects (1/forest district)	3	1887000	▨	▨	▨	▨	▨
	2) UPLOADING NEW VLI DATA INTO CORPORATE	8 Projects (1/forest district)	4	0	▨	▨	▨	▨	▨
Recommended Medium Term Visual Landscape Inventory Strategic Knowledge Investments				**1887000**	355000	392000	500000	372000	268000
Total Recommended Visual Landscape Inventory Knowledge Solutions Investment				**$3774000**	710000	784000	1000000	744000	536000

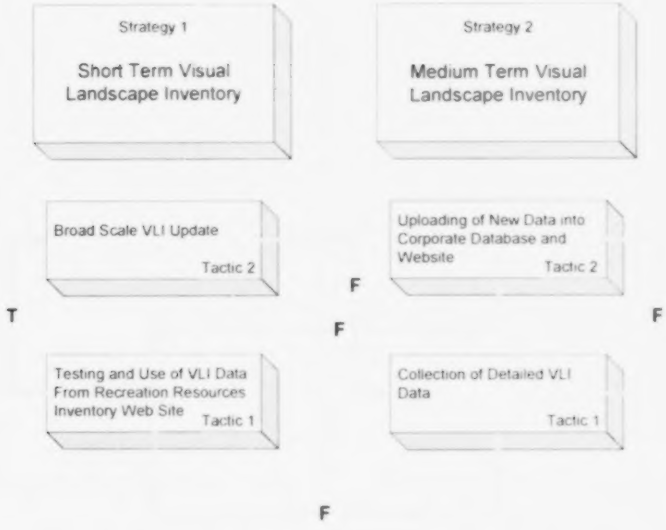

Strategy 1
Short Term Visual Landscape Inventory
Strategy 2
Medium Term Visual Landscape Inventory
Broad Scale VLI Update
Tactic 2
Uploading of New Data into Corporate Database and Website
Tactic 2
F
T
F
F
Testing and Use of VLI Data From Recreation Resources Inventory Web Site
Tactic 1
Collection of Detailed VLI Data
Tactic 1
F

Figure 2.12.2 Interactions and Linkages within the Visual Inventory Knowledge Solution.

detailed VLIs and TSR 3 schedule and time frames. No cost is associated with the tactic since it expected that the task would be the responsibility of the Ministry of Sustainable Resource Management.

Table 2.12.1 presents the detailed cost schedule of all strategies and tactics comprising this knowledge solution.

Table 2.12.1 Visual Landscape Inventory Knowledge Solution Investment Summary.

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. SHORT TERM VISUAL LANDSCAPE INVENTORY	1) TESTING AND USE OF VLI FROM REC. RES. INV. WEB	8 Projects (1/forest district)	1	10000	10000				
	2) BROAD SCALE VLI UPDATE	8 Projects (1/forest district)	2	100000	100000				
Recommended Short Term Visual Landscape Inventory Strategic Knowledge Investments				**110000**	110000				
2. MEDIUM TERM VISUAL LANDSCAPE INVENTORY	1) COLLECTION OF DETAILED VISUAL LANDSCAPE	8 Projects (1/forest district)	3	1887000	355000	392000	500000	372000	268000
	2) UPLOADING NEW VLI DATA INTO CORPORATE	8 Projects (1/forest district)	4	0	0	0	0	0	0
Recommended Medium Term Visual Landscape Inventory Strategic Knowledge Investments				**1887000**	355000	392000	500000	372000	268000
Total Recommended Visual Landscape Inventory Knowledge Solutions Investment				**$3774000**	710000	784000	1000000	744000	536000

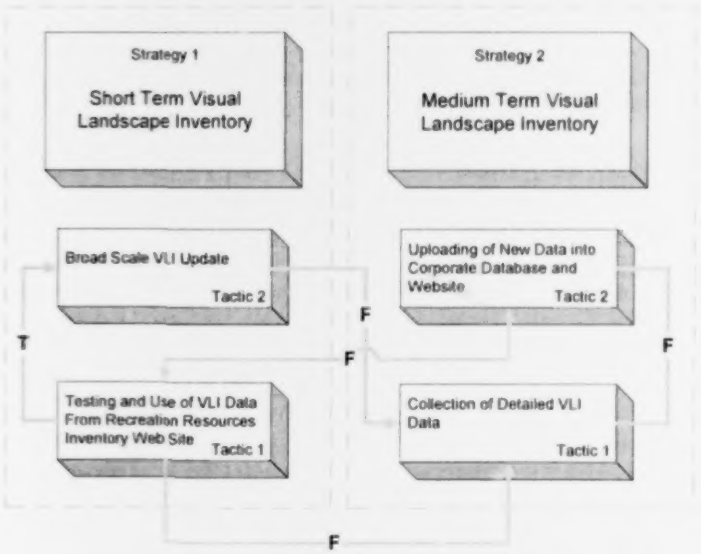

Strategy 1
Short Term Visual Landscape Inventory
Strategy 2
Medium Term Visual Landscape Inventory
Broad Scale VLI Update
Tactic 2
Uploading of New Data into Corporate Database and Website
Tactic 2
T
F
F
F
Testing and Use of VLI Data From Recreation Resources Inventory Web Site
Tactic 1
Collection of Detailed VLI Data
Tactic 1
F

Figure 2.12.2 Interactions and Linkages within the Visual Inventory Knowledge Solution.

ISSUE 13 INADEQUATE UNDERSTANDING OF MANAGED STAND SITE PRODUCTIVITY POTENTIAL

Site productivity is a key determinant of stand dynamics and yield. Sustainable use of timber resources is wholly dependent on the rate of growth of the forest under different management regimes. Predicting forest growth rates and setting limits for forest harvesting, in turn requires accurate estimates of site productivity. AAC determinations by the Chief Forester are largely based on such projections, with important strategic implications for industrial and community stability.

Site productivity estimates are also required for predicting the rate of development and supply of many other forest attributes, including snag/CWD recruitment, seral stage distributions, and crown closure and understorey light levels. Accurate predictions of the supply of these attributes are critical to the management of wildlife habitat supply.

There is uncertainty in the estimation of site productivity potential that requires research and development and monitoring initiatives to resolve. Without an accurate means of projecting stand and ultimately forest growth, the design of realistic, sustainable forest management strategies is not possible.

RECOMMENDED SITE PRODUCTIVITY KNOWLEDGE SOLUTION

As depicted in Figure 1.13.1, the recommended knowledge solution consists of four integrated strategies; each strategy addresses the collection of new data and information to either replace existing estimates of site productivity which are known to be flawed (inventory), or to audit/improve estimates of growth trends (growth modelling). In both cases, new information (data) is required either to test current assumptions/models or to design new models where the existing ones are flawed.

STRATEGY 1:SITE PRODUCTIVITY ESTIMATION

This strategy addresses the need for a forest inventory information base containing land unit specific estimates of site productivity (site index). Three complimentary research and development tactics are proposed:

Tactic 1: Ecosystem Based Estimation of Site Index

This tactic consists of a suitability evaluation of all potential methods for assigning site index values to mapped ecosystem units. Criteria for selecting a method are predictive accuracy, data requirements and cost effectiveness, and which Tactic 1: an evaluation is required to find the most cost effective strategy for assigning site index values to mapped ecosystem units.

Tactic 2: Site Index/Biogeoclimatic Ecosystem Classification (SIBEC) Sampling

The existing SIBEC database offers a method to assign productivity values to land base units, but is incomplete. Further sampling is required to make this application more broadly applicable. This tactic is recommended as a systematic means to complete this program in the region over a five-year period. Field sampling and assignment of SI values should be augmented with additional random sampling and use of other predictive variables.

Tactic 3: Growth Intercept Methodology

There is uncertainty in the accuracy of applying growth intercept methods of site productivity estimation to young interior spruce stands. A suitable growth intercept equation has not yet been developed for predicting site productivity potential in aspen stands.

This tactic consists of two research and development initiatives designed to:

- test the suitability and accuracy of the current GI equations for young spruce stands; and
- design a growth intercept equation suitable for use in trembling aspen stands.

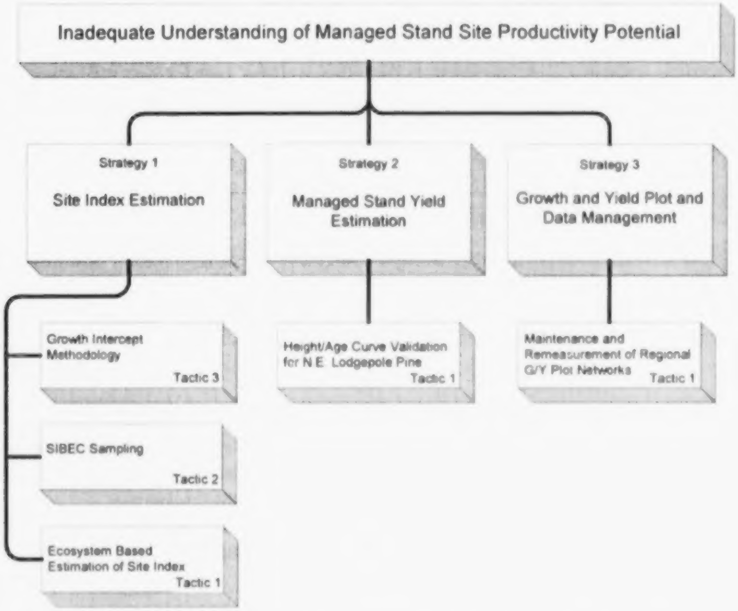

Inadequate Understanding of Managed Stand Site Productivity Potential
Strategy 1
Site Index Estimation
Strategy 2
Managed Stand Yield Estimation
Strategy 3
Growth and Yield Plot and Data Management
Growth Intercept Methodology
Tactic 3
SIBEC Sampling
Tactic 2
Ecosystem Based Estimation of Site Index
Tactic 1
Height/Age Curve Validation for N.E. Lodgepole Pine
Tactic 1
Maintenance and Remeasurement of Regional G/Y Plot Networks
Tactic 1

Figure 2.13.1 **Design of the Managed Stand Site Productivity Knowledge Solution.**

STRATEGY 2:MANAGED STAND YIELD ESTIMATION

The most immediate need for improved managed stand yield estimation is for older (100 year+) stands of lodgepole pine the Peace River subregion. Practising foresters in this area have observed that stands rarely achieve the operational volumes predicted by TIPSY for a given site index. As volume production is closely correlated to height growth, a likely causal factor is that stands in this area experience a more pronounced "flattening off" of the height growth curves than is predicted in the provincial height/age curves.

This strategy consists of a single tactic designed to test for local bias in the height/age data for this species. It calls for construction of a new set of localised height/age curves from a set of 40 stem analysis plots, and comparing with provincial curve sets used in the existing model.

STRATEGY 3:GROWTH AND YIELD PLOT AND DATA MANAGEMENT

The regional growth and yield permanent plot (PSP) network consists of approximately 1500 samples established from 1971 to 2001distributed throughout all TSAs and TFLs. The growth and yield database consists of long-term data from a range of natural (fire origin; old growth; natural regeneration; harvesting disturbance) and managed stand types (single species and mixed species). Most PSP's have been re-measured every ten years according to existing growth and yield protocols (Forest Productivity Council).

The database and plot network is classified by ecological association; it is a key site productivity reference for forest supply projections, silviculture investment analysis and successional dynamics and carbon sequestration modelling. This data is also used for calibrating growth & yield models (VDYP; TASS/Tipsy; MGM; Prognosis), calculating growth increments & annual allowable cuts, assessing managed stand investments, determining operational adjustment factors (OAF's), and monitoring sustainable change criteria and indicators.

The single tactic calls for the continued maintenance and re-measurement of the PSP network, and enhancement of the database.

Table 2.13.1 provides a detailed cost schedule of the recommended strategies and tactics making up this knowledge solution.

Table 2.13.1 **Managed Stand Site Productivity Knowledge Solution Investment Summary.**

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. SITE PRODUCTIVITY ESTIMATION	1) ECOSYSTEM BASED ESTIMATION OF SITE INDEX		1	315000	15000	75000	75000	75000	75000
	2) SIBEC SAMPLING		2	1000000	200000	200000	200000	200000	200000
	3) GROWTH INTERCEPT METHODOLGY	i) Eliminating Bias in Interior Spruce GI Equations	4	20000	20000				
		ii) Aspen Growth Intercept Equations	6	2000	2000				
Recommended Ecosystem Based Site Productivity Potential Strategic Knowledge Investments				**1337000**	237000	275000	275000	275000	275000
2. MANAGED STAND YIELD ESTIMATION	1) HEIGHT/AGE CURVE VALIDATION FOR N.E. PINE		5	65000	65000				
Recommended Yield Curve Projection Strategic Knowledge Investments				**65000**	65000	0	0	0	0
3. GROWTH AND YIELD PLOT/DATA	1) MAINTENANCE AND RE-MEASUREMENT OF REGIONAL GROWTH AND YIELD NETWORKS		3	**729300**	121000	104500	223300	102300	178200
Recommended Growth and Yield Plot and Data Management Strategic Knowledge Investment				**729300**	121000	104500	223300	102300	178200
Total Recommended Managed Stand Site Productivity Knowledge Solution Investment				**$1458600**	242000	209000	446600	204600	356400

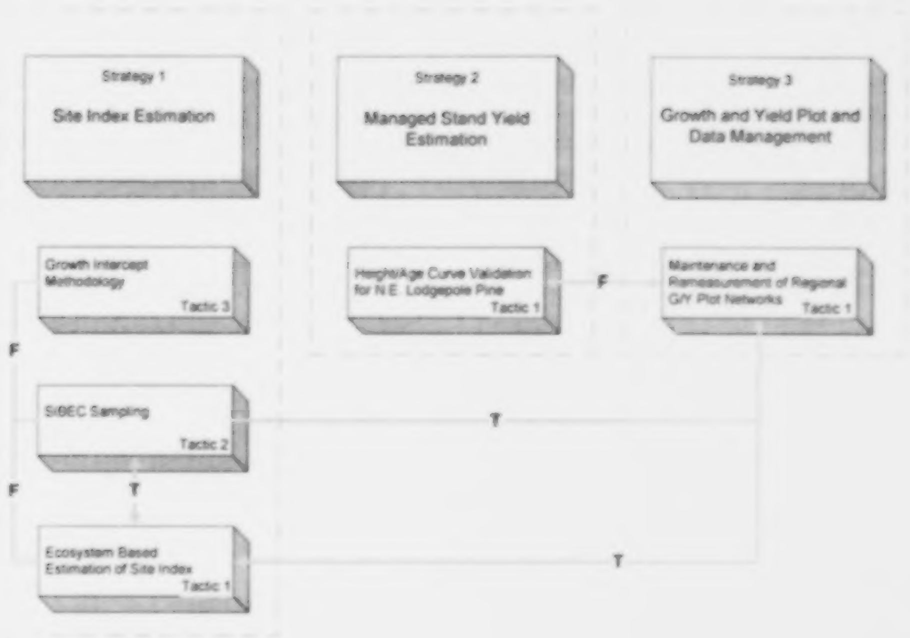
The database and plot network is classified by ecological association; it is a key site productivity reference for forest supply projections, silviculture investment analysis and successional dynamics and carbon sequestration modelling. This data is also used for calibrating growth & yield models (VDYP; TASS/Tipsy; MGM; Prognosis), calculating growth increments & annual allowable cuts, assessing managed stand investments, determining operational adjustment factors (OAF's), and monitoring sustainable change criteria and indicators.

The single tactic calls for the continued maintenance and re-measurement of the PSP network, and enhancement of the database.

Table 2.13.1 provides a detailed cost schedule of the recommended strategies and tactics making up this knowledge solution.

Table 2.13.1 Managed Stand Site Productivity Knowledge Solution Investment Summary.

KNOWLEDGE STRATEGIES	KNOWLEDGE TACTICS	INVESTMENT PROJECTS/ACTIVITIES	Investment Priority Ranking	Investment by Activity ($)	Investment by Period ($/year)				
					02/03	03/04	04/05	05/06	06/07
1. SITE PRODUCTIVITY ESTIMATION	1) ECOSYSTEM BASED ESTIMATION OF SITE INDEX		1	315000					
	2) SIBEC SAMPLING		2	1000000					
	3) GROWTH INTERCEPT METHODOLGY	i) Eliminating Bias in Interior Spruce GI Equations	4	20000					
		ii) Aspen Growth Intercept Equations	6	2000					
Recommended Ecosystem Based Site Productivity Potential Strategic Knowledge Investments				**1337000**	237000	275000	275000	275000	275000
2. MANAGED STAND YIELD ESTIMATION	1) HEIGHT/AGE CURVE VALIDATION FOR N.E. PINE		5	65000					
Recommended Yield Curve Projection Strategic Knowledge Investments				**65000**	65000	0	0	0	0
3. GROWTH AND YIELD PLOT/DATA	1) MAINTENANCE AND RE-MEASUREMENT OF REGIONAL GROWTH AND YIELD NETWORKS		3	**729300**					
Recommended Growth and Yield Plot and Data Management Strategic Knowledge Investment				**729300**	121000	104500	223300	102300	178200
Total Recommended Managed Stand Site Productivity Knowledge Solution Investment				**$1458600**	242000	209000	448600	204600	156400


Strategy 1
Site Index Estimation
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Height/Age Curve Validation for N.E. Lodgepole Pine
Tactic 1
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Maintenance and Remeasurement of Regional G/Y Plot Networks
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SIBEC Sampling
Tactic 2
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Ecosystem Based Estimation of Site Index
Tactic 1
T

Figure 2.13.2 Interactions and Linkages with the Managed Stand Site Productivity Potential Knowledge Solution

APPENDIX 1

Table A-1 Regional Ranking of Management Unit SSFM Issue Submissions- August, 2000.

District	Issue Keyword	Knowledge Keyword	Committee Rank
Dawson Creek	alternative harvest systems	non-timber values, timber values	36
	biodiversity	patterns, attributes	46
	complex stands	stand dynamics, yield projection, stocking standards	26
	endangered species management	red listed species, blue listed species, habitat management	41
	fish habitat, riparian habitat	habitat attributes	37
	grazing/forestry interaction, forest productivity	stocking status, grazing impact	15
	mixedwood	stand dynamics, stocking standards, yield projection	44
	planning, linkages	strategic planning, operational planning, decision tools	40
	problem forest type	utilization potential	27
	unreliable inventories	accuracy, completeness data access	50
	wildlife	grizzly bear, caribou, habitat capability	44
Fort Nelson	alternative harvest system, natural disturbance	non-timber values, timber values, stand dynamics	37
	archeological values	prediction tools	37
	biodiversity, natural disturbance	patterns, attributes	38
	caribou	suitability	50
	lakeshore protection	lake classification	20
	moose health	health attributes	3
	netdown	operability	24
		riparian	20
	understory	detection, attributes	39
	unreliable inventories	reliability, completeness, vintage	56
	vegetation management	tactics, demonstration	22
	waterfowl habitat	attributes	26
Fort St. James	access management, recreational use	caribou habitat, impacts	39
	alternative harvesting systems	riparian management zones	39

	archeological values, aboriginal values	sites, trails	40
	caribou	habitat, capability	49
	data management	fish resource data, wildlife resource data	31
	ecosystem management	attributes, spatial delineation	36
	environmental contamination, public safety	site location, hazard potential	20
	fish habitat	blue listed species	40
	high elevation	regeneration, harvesting	34
	recreation opportunities	trails, sites, lakes	35
	soil conservation	unstable terrain	34
	visual sensitivity	landscape planning	40
Fort St. John	alternative harvest systems	timber values, non-timber values	36
	biodiversity	patterns, attributes	48
	endangered species management	red listed species, blue listed species, habitat management	43
	fish habitat, riparian habitat	habitat attributes	41
	grazing/forestry interaction, forest productivity	stocking status, grazing impact	11
	linkages	decision tools, operational planning	45
	mixedwood	stand dynamics, yield projection, stocking standards	40
	soil conservation	terrain stability	28
	unreliable inventories	reliability, completeness, vintage	51
Mackenzie	biodiversity, natural disturbance	patterns, attributes	45
	complex stands	silvicultural practices, socio-economic analysis	28
	data management	resource data access, data sharing	22
	fish habitat, riparian habitat	habitat attributes	45
	growth and yield	managed stand yields, site productivity	34
	netdown	operability	20
	pests	impacts, prediction	33
	recreation	opportunities, features, values, use	31
	terrain stability, soil conservation	environmental damage	29
	traditional use,	sites, trails	38

	archeological values		
	visual sensitivity	landscape planning	33
	wildlife	habitat use, forestry impacts	48
Prince George	biodiversity, natural disturbance	patterns, attributes	43
	cultural values, archeological values	sites, features	32
	ecosystem management	attributes, spatial delineation	32
	fish habitat	blue listed species	43
	recreation opportunities	sites, features	29
	recreational impacts	use preferences, motorized use, non-motorized use	29
	site productivity	site index, yield curves	37
	succession,natural/managed stands	attributes, dynamics, structure	40
	unreliable inventory, resource data management	completeness, accuracy, access	49
	wildlife habitat	capability, suitability	48
Robson Valley	alternate harvesting systems	habitat attributes	40
	alternative harvesting systems	non timber values, non-timber values	40
	avalanche hazard	harvesting impacts	11
	biodiversity	BEC classification	25
	flood prediction	weather attributes	12
	netdown	decay factors	20
		riparian areas	22
	pest management	marsh thistle, biological control	30
	recreational opportunities	trails	33
	recreational values	features, VQ0	36
	site productivity	site index, yield curves	37
	soil conservation	landslides	23
		terrain stability	34
	traditional use	cultural values	35
	unreliable inventory	accuracy	39
Vanderhoof	alternative harvest systems	non-timber values, harvesting impacts	36
	carbon, sink	carbon cycle	9
	caribou	habitat, capability, suitability, impacts	51
	data management	resource data, data access, data sharing	18
	fish	species, habitat, stream classification	38

	landscape unit planning	timber values, non-timber values, integrated resource management	39
	mixedwood	stand conversion, biodiversity	33
	natural disturbance, biodiversity	attributes, patterns	43
			45
	netdowns	OAF's	21
	pests	prediction, impacts	43
	problem forest types	utilization potential, merchantability, operability	20
	recreation	historic trails, cultural sites, recreational sites	33
	SFM performance measurement	attributes, indicators, criteria	39
	site productivity	site index, yield curves	37
	socio-economics	decision-tools	27
	soil conservation	terrain stability, landslides, water quality, erosion	29
	traditional use	cultural values	38
	unreliable inventories	existence, accuracy	48
	utilization	volume	26
		volume, merchantability	22
	visual sensitivity	landscape planning	35
	wildlife	grizzly bear, moose, habitat capability	44
Prince George Region	access management	resource use impacts	31
	biodiversity	old growth management areas	38
	caribou	distribution, abundance, habitat use	46
	data management, spatial	TRIM II, orthophotos	42
	fish	distribution patterns	41
	forest productivity enhancement	nutrients	16
	inventory completeness	red listed species, blue listed species	49
	species and habitat protection	riparian guidelines	35
	terrain stability	landslide prone soils	25
	water production	natural variation	28
	wildlife	otters	15
		ungulate range	38

APPENDIX 2

THE MACKENZIE STRATEGIC RESOURCE MANAGEMENT PLAN

Mackenzie Strategic Resource Management Plan

2002/03 – 2006/07

January, 2002

MACKENZIE STRATEGIC RESOURCE MANAGEMENT PLAN

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APPENDIX 4 – MACKENZIE FOREST DISTRICT RESOURCE MANAGEMENT PLAN PROCESS 50

1. Introduction

The purpose of the Mackenzie Strategic Resource Management Plan (MSRMP) is to identify and implement significant resource investment priorities for the Mackenzie Timber Supply Area (TSA). These priorities will reflect:

- resource management objectives for the Mackenzie TSA (Land and Resource Management Plan {LRMP}, Resource Management Plan {RMP}, Timber Supply Review {TSR}, etc.);
- regional output targets and RMP priorities provided by Forest Renewal BC (FRBC);
- the technical expertise and advice of forest licensee stakeholders; and
- the resource management stewardship responsibilities of the Ministries of Water, Land and Air Protection (MWLAP), Sustainable Resource Management (MSRM) and Forests (MoF).

The MSRMP was developed by the Mackenzie TSA RMP Planning Group which includes representation from the Ministry of Forests, Ministry of Water, Land and Air Protection, Ministry of Sustainable Resource Management, Abitibi Consolidated, Slocan Forest Products and Forest Renewal BC. The Plan was approved by the Mackenzie Senior Managers Group, which includes representation from all organizations on the Mackenzie TSA RMP Planning Group with the exception of Forest Renewal BC.

The MSRMP incorporates local issues and priorities into a five-year strategic planning framework and has been developed as a pilot for the regional RMP process. The objective of the pilot SRMP planning process in the Mackenzie Planning Unit is to provide increased flexibility to assist the Planning Group in reaching agreement on investment priorities. The increased flexibility will apply to the timing and outputs of projects delivered within a five-year timeframe consistent with Forest Renewal BC's targets and priorities.

The Mackenzie SRMP process is unique in that it is a multi-stakeholder, consensus-based process that identifies multi-year priorities based upon an assessment of issues that are of significance to sustainable forest management in the Mackenzie TSA. The process addresses the traditional boundaries of Forest Renewal BC's strategic objectives, but goes beyond them in terms of developing strategic priorities that provide long term solutions that are directly applicable to the issues and objectives in the Mackenzie TSA. A copy of the Mackenzie Forest District Resource Management Plan Process document that was developed to guide the MSRMP planning process is included as Appendix 4.

The following steps were followed to develop the MSRMP:

1. Review work done to date to identify TSA management objectives (LRMP, TSR, etc.) and update where necessary.
2. Identify regional output targets and RMP priorities that apply to the Mackenzie TSA.
3. Identify strategic priorities for the Mackenzie TSA based on strategic direction (e.g., LRMP), regional output targets, RMP priorities and priorities identified for the 2000 RMP.

4. Develop five-year action plans and budget allocations for each strategic priority[1].
5. Plan review and approval.

The development of the MSRMP was guided by the following principles:

1. The process will be clear, simple and easy to understand;
2. All stakeholders will participate on an equal basis;
3. Decisions will be developed by consensus;
4. All stakeholder interests will be represented in the strategic plan;
5. Projects and activities must be implementable;
6. All stakeholders will be accountable for the implementation of projects and activities;
7. The process will include annual reviews of strategic priorities; and
8. The overall pilot planning process will be reviewed annually to determine if it is achieving its goals.

Upon completion of the MSRMP, the Mackenzie TSA RMP Planning Group will meet annually to review progress and make changes to strategic priorities and five-year implementation plans as appropriate. If a major change regarding assumptions in the MSRMP occurs (e.g., changes in Forest Renewal BC funding commitments), the Planning Group will schedule a meeting to address the issue and make changes to the MRSMP as appropriate.

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[1] Annual and five-year funding budgets were based upon Forest Renewal BC's forest and environment strategic objective output targets.

2. Vision

The Mackenzie Strategic Resource Management Plan is a multi-stakeholder, consensus-based plan that identifies priorities for sustainable forest management in the Mackenzie TSA that will enhance the long term health and productivity of forest ecosystems, sustain harvest levels and contribute to a strong local economy.

3. Issues and Opportunities

In developing the Mackenzie Strategic Resource Management Plan, several issues and opportunities were identified that are considered significant for future management of the forest resource in the Mackenzie Timber Supply Area. These included:

- Vegetation Resources Inventory
- Terrestrial and Predictive Ecosystem Mapping
- Growth and Yield
- Forest Health
- Sustainable Harvest (Backlog Silviculture and Enhanced Forestry)
- Terrain Stability
- Baseline Resource Mapping
- Caribou
- Wildlife and Wildlife Habitat
- Fish and Fish Habitat
- Water Quality and Watershed Restoration
- Archaeology
- Visual Quality
- Recreation

3.1 Vegetation Resources Inventory (VRI)

VRI is an inventory toolbox that is used to assess the quantity and quality of timber and other vegetation resources. It consists of three components: photo interpretation, ground sampling and statistical adjustment. Measurements include:

- tree attributes (including species, tree measurements, crown class, log grade, tree loss indicators, wildlife codes and health information);
- plant lists and percent cover (a detailed description of all types of vegetation including species, cover, height of shrubs, herbs and bryophytes);
- ecological site description;
- soil description (soil type, nutrients and moisture regime);
- old-growth designation;
- coarse woody debris (comprises all types of woody material found on the ground and in various stages of deterioration); and
- range resources.

Issues	Opportunities
Current timber and non-timber inventories are inadequate for decision-making	• Develop VRI as a tool to support decision-making
Timber inventories outdated for northern third of TSA	• Complete aerial photo coverage and photo interpretation
No statistically-based ground sampling	• Undertake ground sampling in vegetated tree areas to provide statistically valid timber volumes and attributes

3.2 Terrestrial and Predictive Ecosystem Mapping (TEM/PEM)

Ecosystem maps, along with associated interpretations, supply valuable information for many uses, particularly planning resource allocation. The maps are used to meet many Forest Practices Code-related needs, including landscape unit planning, forest development planning, range use planning and the development and application of biodiversity guidelines, riparian guidelines, and the Identified Wildlife Management Strategies. Ecosystem mapping provides:

- a biological and ecological framework for land management;
- a means of integrating abiotic and biotic ecosystem components on one map;
- basic information on the distribution of ecosystems from which management interpretations (e.g., landscape unit planning and site-specific interpretations) can be developed;
- a basis for rating values of resources or indicating sensitivities in the landscape;
- a historic record of ecological site conditions that can be used as a framework for monitoring ecosystem response to management; and
- a demonstration tool for portraying ecosystem and landscape diversity.

Terrestrial Ecosystem Mapping (TEM) is the stratification of a landscape into map units, according to a combination of ecological features, primarily climate, physiography, surficial material, bedrock geology, soil, and vegetation.

Predictive Ecosystem Mapping (PEM) is a computer, GIS, and knowledge-based method to assist in the stratification of landscapes into ecologically oriented map units (typically site series). These are based on the overlaying of mapped themes and the processing of resultant attributes by inference methods (normally automated software) in association with a formalized knowledge base comprising ecological-landscape relationships.

Issues	Opportunities
Current non-timber inventories are inadequate for decision-making	• Develop PEM and TEM as a tool to support decision-making
Timber inventories are outdated for the northern third of the TSA	• Complete aerial photo coverage and photo interpretation
Biogeoclimatic: • inaccurate variant/subzone information • lack of mapped site series information	• Complete biological ecosystem classification (BEC) sub zone mapping for priority landscape units • Complete PEM and site series mapping for priority landscape units
No statistically based ground sampling	• Undertake ground sampling in vegetated tree areas to provide statistically valid timber volumes and attributes

3.3 Growth and Yield

There is a high level of uncertainty surrounding growth and yield information in the TSA. Opportunity exists to improve Growth and Yield Monitoring by observing the growth and yield of a forest and comparing this with the predicted growth and yield of the same forest to assess risk and uncertainty around predictions. Growth and Yield Monitoring complements and adds value to Vegetation Resource Inventories (VRI).

The following three categories of growth and yield require monitoring:

- Individual Tree
- Silviculture
- Inventory

Issues	Opportunities
Current volume and taper equations (especially for Interior spruce) and decay and waste losses produce inaccurate timber volume results	• Monitor and compare observations to predictions for: • volume and taper equations • net volume adjustment • estimates of site quality • stand growth
Need to understand interactions between treatments, sites, species, timing of treatments and prior treatments	• Monitor observe and develop/refine predictive models for: • pest impacts on stand growth and yield • characteristics of wood quality • successional change • habitat/biodiversity • forest health

3.4 Forest Health

Forest land managers in Mackenzie have limited access to forest health data and predictive models that are specific to the Mackenzie TSA. Forest pests and disease account for significant productive volume loss in both mature and developing timber.

Opportunity exists to improve our understanding of forest pests and disease through overview assessments and development of predictive models, so that strategies to reduce timber volume losses to pests and disease can be formulated.

Issues	Opportunities
Pest and disease infestations including: • bark beetles (spruce, lodgepole pine and balsam fir) in mature timber • budworm (spruce and balsam fir) in mature timber • stem rusts (western gall rust, comandra blister rust, stalactiform blister rust) in immature pine stands • weevils (root collar weevil, spruce weevil) in plantations	• Improve knowledge about forest pests and diseases through: ◆ overview assessments ◆ development of predictive models ◆ formulation of strategies to reduce timber volume losses to pests and disease

3.5 Sustainable Harvest (Backlog Silviculture and Enhanced Forestry)

The recently completed TSA base case (April 2001) shows that there is no short or medium term impact on timber. Therefore, the Mackenzie TSA RMP Planning Group feels that the highest priority and greatest opportunity for the Mackenzie TSA is in investments that will address information gaps and outdated inventories for the next Timber Supply Review. This will require a substantial reduction in the Sustainable Harvest Program. The key issues and potential silviculture strategies identified in the 2000 RMP remain unchanged. The difference in 2001 is that these activities will address potential increases in timber supply rather then alleviate potential downfalls over the planning time horizon.

Issues	Opportunities
Uncertainty in the status of the Pre-87 logging and fire disturbed landbase	• Conduct an accelerated stocking/free growing assessment to maintain up to date information on land status and brushing treatment needs
Loss of productivity on backlog Non Sufficiently Restocked (NSR)	• Conduct surveys to determine which areas are good investments
Loss of productivity on stands impeded by broadleaf vegetation	• Conduct on the ground surveys to classify "older" backlog stands and determine those with highest priority for treatment

Managed stand pathogens and pests	• Minimize the impact of pine rust diseases (see Forest Health – Section 3.4)
Orchard seed availability	• Ensure that existing seed supply and orchard seed production meet current or projected local reforestation needs
Operational planning and completion of Type 2 silviculture analysis	• Complete Type 2 analysis and a new silviculture investment strategy for the Mackenzie TSA

3.6 Terrain Stability Mapping

Terrain stability mapping identifies unstable land areas by inventorying the character and distribution of surficial materials and the active geomorphic processes affecting a site. Terrain maps are interpreted to identify forest sites with a moderate or high potential for landslides and a high or very high potential for surface erosion, and to predict where there is significant risk of landslides damaging a stream.

Issues	Opportunities
Incomplete terrain stability mapping in Mackenzie TSA	• Complete terrain stability mapping at the appropriate inventory level

3.7 Baseline Resource Mapping

The TRIM II program provides updated topographic maps showing accurate locations of roads, landings, seismic lines etc. TRIM II provides improved resolution and accuracy in capturing the presence of smaller streams and topographic contours.

Issues	Opportunities
TRIM is inaccurate for operational planning and TRIM II is incomplete	• Complete aerial photo coverage for priority landscape units

3.8 Caribou

In both the Regional and the Mackenzie RMP, caribou management has been addressed separately from the management of other wildlife and species at risk because they have a more obvious and direct response to forestry operations. In Mackenzie, specific direction regarding caribou management has been given to the District through its LRMP recommendations. Forest operations will affect the distribution and abundance of caribou populations and the health and well being of individual caribou. Forestry related impacts constrain food supply, and increase predation rates through creation of high road densities (associated wolf and human pressures).

Issues	Opportunities
Lack of adequate information on: • habitat needs • population levels	• Conduct basic inventory of abundance, seasonal movements, and habitat needs • Develop, implement, and monitor a strategic management plan for caribou

3.9 Wildlife and Wildlife Habitat

Improving the completeness, reliability, and consolidation of wildlife and wildlife habitat information for species at risk and general wildlife is a high priority for the Mackenzie District. The ability to establish clear and measurable management objectives for species and habitats is a prerequisite to achieving sustainable forest management. Addressing wildlife and wildlife habitat through the collection of additional inventory, consolidation of existing information, and the development of predictive decision support tools is recommended as a means of clarifying future timber supplies, and obtaining forest certification.

At the Regional RMP level, a list of threatened and endangered species along with general wildlife (moose, elk, deer, pine marten, stone sheep, mountain goat, goshawk, and waterfowl) have been identified and prioritized with recommendations for knowledge building activities. Species of concern in the Mackenzie TSA include:

- Bull Trout
- Wolverine
- Grizzly Bear
- Fisher
- Northern Long-Eared Myotis
- Mountain Goat
- Stone Sheep

Issues	Opportunities
Bull Trout	• quantify long term population trends • determine the regional population distribution • develop management strategies
Wolverine	• facilitate the completion of data analysis and reporting for the Mackenzie Northern Wolverine Project

Grizzly Bear	• obtain information on:
	  • population density estimates
	  • reproductive rates
	  • mortality rates
	  • seasonal habitat-use patterns and critical habitat types (seasonal movements, home ranges, food habits)
	• develop predictive habitat use models

Fisher	• collect information and develop guidelines and tools to facilitate the management and conservation of fishers and their habitat

Northern Long-Eared Myotis	• Conduct inventories of distributions and habitat use • Develop predictive models
Mountain Goat	• Assess population status • Investigate habitat use and identify high value habitat • Locate mineral lick sites
Stone Sheep	• Identify high value stone sheep habitat
Habitat features	• Identify significant habitat features to enable management/maintenance across the landscape • Track priority resource features (e.g. mineral licks, game trails, rutting areas, natal areas, and seeps) • Identify travel and connectivity corridors • Develop predictive models

3.10 Fish and Fish Habitat

General populations of fish and fish habitat are potentially at risk from human activities that affect their habitat (e.g., access, food supply, water quality, etc.). Increased fisheries knowledge will help decision-makers conserve biological diversity and facilitate the achievement of forest certification by licensees. More complete knowledge of fish forestry interactions and aquatic ecosystem dynamics will provide the information to manage more effectively across the variety of ecosystems in the region and refine standard operating procedures (SOPs), such as timing windows and measures, to management units or to watershed level where appropriate.

Issues	Opportunities
Abundance and diversity of fish: • habitat needs • population levels • habitat enhancement • riparian management	• Conduct fish inventories in priority watersheds • Use predictive models to determine fish distribution and habitat capability in unsampled areas • Develop a broader understanding of aquatic ecosystem dynamics

3.11 Water Quality and Watershed Restoration

A number of guidelines and requirements have been developed to maintain water quality under the Forest Practices Code (FPC) (e.g., riparian management areas). However, research and monitoring to determine the outcomes of these guidelines has not been carried out. As the forest industry becomes more concerned with achieving sustainable forest management and corresponding recognition through forestry certification programs, there is a need to develop indicators and monitoring systems that demonstrate achievement of water quality performance goals.

The Watershed Restoration Program (WRP) was initiated under Forest Renewal BC's strategic objective: "Enhancing Environmental Values" with the aim of restoring high priority watersheds across the region. The regional target identified by Forest Renewal BC for its WRP is to restore 20 percent of the very high priority or critical watersheds for fish or domestic water supply values by 2005. Mackenzie's contribution towards meeting this regional target is to complete restoration on the Lower Mesilinka, Lower Osilinka, Misinchinka, Nation, and Russell watersheds by 2005.

Issues	Opportunities
Need to restore high priority watersheds affected by previous development activities or natural disturbances	• Undertake assessment, restoration and monitoring of high priority watersheds in the Mackenzie TSA
Need to address "hot-spot"[2] watershed issues	• Address "hot spot" issues on an annual basis to implement fish culvert passage and hillslope instability problems
Need to monitor achievement of water quality objectives	• Conduct water sampling in priority watersheds

3.12 Archaeology

In areas where there are likely to be heritage values it is important to undertake an archaeological assessment to determine the existence and significant of these values and to develop appropriate management strategies. There are two main study types:

- **Archaeological Overview Assessment (AOA)** - estimates an area's potential to contain archaeological resources and determines the need for subsequent impact assessments and management; and
- **Archaeological Inventory Study (AIS)** - field surveys to locate and record archaeological sites within a proposed study area and supports information requirements of an AOA.

Issues	Opportunities
Culture and heritage values: • archaeological sites • trail locations	• Develop inventory and modeling tools for archaeological values

3.13 Visual Quality

A visual landscape inventory work plan was completed for the Omineca-Peace region in 2001. The work plan provides cost estimates and prioritization for acquiring new data over the next 5 years. A listing of the viewsheds, priority and target completion date is provided in Appendix 2.

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[2] The investment priorities and implementation plan within the Mackenzie RMP does not specifically address WRP "hot-spot" issues". In the context of WRP, "hot spots" mainly refer to stream crossings (typically culverts) that block fish passage, and road failures or landslides attributable to pre-FPC forest harvesting activity.

Issues	Opportunities
Need to identify and manage visually sensitive landscapes	• Identify visually sensitive landscapes and develop strategies for managing visual quality

3.14 Recreation

In order to demonstrate that the resource is being managed for multiple resource values and that good land stewardship is practiced, all locations of significant and important recreation features should be mapped. These important features include thermal springs, white water classifications, canoe routes, waterfalls, caves, karsts, unusual/rare rock or mineral deposits and historical sites. These are all physical features, which once mapped are unlikely to change.

A recreation features inventory exists for the region. A review is required to determine whether it is complete and accurate. Comments from district staff and other local experts indicate that features are missing. Such features as caves and karsts are extremely difficult to inventory since they are hidden from view and require input from local experts.

Issues	Opportunities
• Need for complete Recreation Features Inventory	• Review existing Recreation Feature Inventory • Identify areas where knowledge gaps exist and where improvement is required • Identify and evaluate available mapping tools

4. TSA Objectives, Regional Targets and Priorities

The Mackenzie Strategic Resource Management Plan is guided by the resource management objectives for the TSA developed through other processes such as the Mackenzie Land and Resource Management Plan and the Timber Supply Review. Regional targets and priorities developed by Forest Renewal BC have also been used as a reference in developing the plan. A summary of Forest Renewal BC's regional targets and priorities is provided in Appendix 3.

The Mackenzie LRMP – completed in 2000 – provides strategic management direction for the Mackenzie TSA through the establishment of resource management zones (RMZs) that identify appropriate use of the land and objectives and strategies that provide general management direction for the various resource values addressed in the plan. Objectives outline the broad intent or conditions that must be met with respect to the various resources and strategies indicate how the intent will be achieved. A summary of the key LRMP and TSR objectives that relate to the MSRMP is provided in the following table.

Resource Value	Objective
Biodiversity	• Manage for natural biodiversity by maintaining functioning and representative ecosystems across the plan area
Soils	• Minimize soil erosion and/or productivity losses • Address soil disturbance and loss of soil productivity from past resource development activities
Water	• Manage resource use activities/human activities to maintain water quality • Restore water quality where it has been degraded by past resource management activities • Manage potential effects of resource development activities on natural stream flow regime to maintain watershed hydrological integrity
Fish and Fish Habitat	• Conserve the abundance and diversity of naturally occurring fish and shellfish populations and their habitats • Maintain or enhance habitat of threatened or endangered (red-listed) and vulnerable (blue-listed) fish and shellfish species
Wildlife and Wildlife Habitat	• Maintain habitat needs of all naturally occurring wildlife across the Plan area • Maintain or enhance habitat of threatened or endangered (red-listed) and vulnerable (blue-listed) and regionally important wildlife species, but not to the detriment of the ecosystem as a whole • Manage wildlife populations at sustainable levels to meet both consumptive and non-consumptive uses, consistent with the management direction of each RMZ

Caribou	• Manage and perpetuate caribou and caribou habitats in the Mackenzie LRMP area within the context of other wildlife species, continued resource extraction activities, increased human activities, and existing and increased recreation use • Establish a Biologist's Technical Committee for Caribou Management (BTCCM), to advise on further inventory, research and monitoring of caribou and caribou habitat and on refined and adaptive caribou management direction
Grizzly Bear	• Identify and manage to conserve grizzly bear habitat to assist in sustaining viable populations • Improve the management interactions between grizzly bears and humans • Manage access to maintain healthy grizzly bear populations
Forest Resources	• Maintain opportunities for sustainable timber harvesting and related forest management activities to optimize the benefits to communities in the Plan Area • Maintain a sustainable timber harvest from the available land base with due regard to the effects of silviculture systems on other resources • Where possible, the social, economic and local community stability benefits of forestry should accrue to communities in the Plan Area • Maintain the opportunity for the sustainable use of botanical forest products such as wild berries, mushrooms and medicinal plants
Timber	• Implement recommendations in the 2001 TSR including: • Review and redefine economic operability data, in particular in balsam leading stands and in stands in far zone (long hauling distance) • Monitor harvest activities in the far zone • Monitor the performance in deciduous-leading stands • Monitor the performance in balsam-leading stands • Conduct a study on site productivity specific to the TSA • Complete the vegetation resource inventory for the TSA, in order to provide data to help evaluate existing stand volumes • Redefine the inventory information on riparian areas and clarify the applicable management regimes
Recreation and Tourism	• Maintain opportunities for a diverse range of recreational and tourism values and uses across the Plan Area
Heritage and Culture	• Identify and manage cultural and heritage values

5. Strategic Priorities and Five-year Implementation Plans

The Mackenzie TSA RMP Planning Group identified nineteen strategic priorities for the TSA based upon a review of:

- key resource management issues facing the TSA (see Section 3);
- strategic resource management objectives that have been developed through other processes such as the LRMP (see Section 4);
- Regional targets and priorities developed by Forest Renewal BC (see Appendix 3); and
- Professional judgment of the members of the Group.

Table 5.1 identifies the eighteen strategic priorities for the Mackenzie TSA and indicates the proposed completion date, 5-year budget and reference to FRBC's three land and environment based strategic objectives (SSFM, SH and EEV).

5.1 Mackenzie Strategic Investment Priorities: 2002/03-2006/07

Strategic Priority	Date	Budget	Reference[3]
1. TRIM II completion	2002/03	$615,000	SSFM[4]
2. Vegetative resource inventories	March 2005	$7,140,000	SSFM (Issue 1)
3. Silvicultural investment strategy	2002/03	$20,000	SH
4. Caribou management	2002/03	$700,000	SSFM (Issue 2)
5. Predictive ecosystem mapping	2006/07	$800,000	SSFM (Issue 1)
6. Interim sustainable harvest program	2001/02	$2,230,000	SH
7. Terrain stability mapping	2006/07	$1,500,000	SSFM (Issue 1)
8. Growth and yield	2002/03	$225,000	SSFM (Issue 3)
9. Species at risk and general wildlife	2006/07	$2,000,000	SSFM (Issue 3, 4)
10. Fish and fish habitat	2006/07	$1,860,000	SSFM (Issue 7)
11. Completion of sustainable harvest obligations (stocking/free-growing surveys)	2007/07	$315,000	SH
12. Watershed restoration 2004	2004	$800,000	EEV
13. Forest health	2006/07	$175,000	SSFM (Issue 9)
14. Caribou and human disturbance impacts; caribou habitat supply (lichen)	2006/07	$340,000	SSFM (Issue 2)
15. Recreation inventory	2006/07	$50,000	SSFM (Issue 1)
16. Archeological overview assessments	2003/04	$20,000	SSFM (Issue 11)
17. Visual sensitivity objectives	2003/04	$200,000	SSFM (Issue 12)
18. Watershed restoration 2005-2010	2005-2010	$620,000	EEV
19. Future sustainable harvest priorities		$3,450,000	SH
Five Year Investment Total		**$23,060,000**	

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[3] These references refer to the regional resource management plan.

[4] TRIM 2 is prerequisite for all other SSFM issues and as such does not have an "issue" number.

5.2 Five-year Implementation Plans

5.2.1 TRIM II Completion (SSFM)

The TRIM II program provides updated topographic maps showing accurate locations of roads, landings, seismic lines etc. TRIM II provides improved resolution and accuracy in capturing the presence of smaller streams and topographic contours. Digital orthophotos are also provided by the program; orthophotos can be used as a landscape view in support of maps and other thematic products generated from photo-interpretation.

Year	Activity	Budget	Lead Proponent
2002/03	Complete 180 map sheets for Mackenzie District	$615,000	Abitibi and Slocan
2003/04		$0	
2004/05		$0	
2005/06		$0	
2006/07		$0	
	Total	**$615,000**	

5.2.2 Vegetative Resource Inventories (SSFM)

Vegetation resource inventories (VRI) are designed to determine the amount of vegetation cover in the province, the location of vegetation resources and the changes in the amount and location over time. The VRI consists of two phases:

1. an estimation phase supplied by photo-interpreted vegetation attributes including estimates of derived attributes of site index and volume; and
2. monitoring to check and adjust photo estimates from ground sampling data.

Year	Activity	Budget	Lead Proponent
2002/03	Photography Photo retrofit Ground sampling Quality assurance Project management	$ 800,000 1,100,000 100,000 10,000 20,000 $2,030,000	Abitibi
2003/04	Photo retrofit Ground sampling Quality assurance Project management	$2,000,000 250,000 25,000 50,000 $2,325,000	Abitibi
2004/05	Photo retrofit Ground sampling Quality assurance Project management	$ 2,310,000 200,000 20,000 40,000 $2,570,000	Abitibi
2005/06	Ground sampling Quality assurance Project management	$ 50,000 5,000 10,000 $65,000	Abitibi
2006/07	Monitoring	$ 150,000	
	Total	**$7,140,000**	

5.2.3 Silvicultural Investment Strategy (SH)

The objective of the Type 2 silviculture analysis is to develop a comprehensive silviculture strategy for the Mackenzie TSA[5]. Some of the outputs from this strategic planning initiative include:

- a rational investment plan for future silviculture funds;
- a series of detailed objectives and performance indicators at the management unit level; and
- standardized analysis output so that budget allocations can be evaluated and prioritized on a consistent basis.

Year	Activity	Budget	Lead Proponent
2002/03	Define a new Silvicultural Investment Strategy: • develop detailed tactical plan outlining future investment priorities • resolution of local admin./implementation issues	$20,000	Mackenzie TSA RMP Planning Group
2003/04		$0	
2004/05		$0	
2005/06		$0	
2006/07		$0	
	Total	**$20,000**	

5.2.4 Caribou Management (SSFM)

Stakeholders in Mackenzie have undertaken a multi-year project, “Ecological Factors Affecting Northern Caribou in the Omineca Region, BC”, to address caribou and caribou habitat, for which resultant information and decision support tools may be applied in other parts of the Omineca-Peace region. 2002/03 is the last year of effort to complete the data collection and model development. Monitoring and adaptive management feedback is planned in 2006/07, and again at five-year intervals.

Year	Activity	Budget	Lead Proponent
2002/03	Complete caribou management objectives, extension and training using existing model: • completion of adaptive management model • extension of results to all stakeholders	$600,000	Slocan
2003/04		$0	
2004/05		$0	
2005/06		$0	
2006/07	Monitoring and adaptive management feedback	$100,000	Slocan
	Total	**$700,000**	

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[5] The sustainable harvest strategy will address interim silviculture commitments and will include an analysis of future silviculture priorities which will be funded under Activity 19.

5.2.5 Predictive Ecosystem Mapping (SSFM)

PEM stratifies the landscape into map units based on ecological criteria – primarily climate, physiography, surficial materials and vegetation. It is used for interpreting forest, range, wildlife, soils and biodiversity, and is often done in conjunction with terrain stability mapping.

Year	Activity	Budget	Lead Proponent
2002/03	Complete PEM/TEM for Priority RMZs • BEC • TEM • PEM	 $250,000 $10,000 110,000 $370,000	Slocan and Abitibi
2003/04	• BEC • PEM	$120,000 250,000 $370,000	Abitibi
2004/05	• PEM	$60,000	Abitibi
2005/06		$0	
2006/07		$0	
	Total	**$800,000**	

5.2.6 Interim Sustainable Harvesting Program (SH)

The highest priority brushing activities are those under which there are legal obligations. These works include all activities needed to produce a free growing stand where a backlog silviculture prescription has been approved (previously fill-planted areas - previous obligations/investments).

Year	Activity	Budget	Lead Proponent
2002/03	Implement interim SH investment program	$735,000	Abitibi and Slocan
2003/04	Implement interim SH investment program	$500,000	Abitibi
2004/05	Implement interim SH investment program	$515,000	Abitibi
2005/06	Implement interim SH investment program	$470,000	Abitibi
2006/07	Implement interim SH investment program	$10,000	Abitibi
	Total	**$2,230,000**	

5.2.7 Terrain Stability Mapping (SSFM)

By inventorying surficial materials and active geomorphic processes affecting a site, produce terrain maps are produced that identify moderate to high potential for landslides or erosion. Terrain stability mapping is often done in conjunction with terrestrial ecosystem mapping.

Year	Activity	Budget	Lead Proponent
2002/03	Complete terrain stability mapping (mostly level E and some level C) for priority RMZs	$300,000	Abitibi and Slocan
2003/04	Complete terrain stability mapping for priority RMZs	$300,000	Abitibi and Slocan
2004/05	Complete terrain stability mapping for priority RMZs	$300,000	Abitibi and Slocan
2005/06	Complete terrain stability mapping for priority RMZs	$300,000	Abitibi and Slocan
2006/07	Complete terrain stability mapping for priority RMZs	$300,000	Abitibi and Slocan
	Total	**$1,500,000**	

5.2.8 Growth and Yield (SSFM)

This includes the installation and re-measurement of permanent sample plots, data processing and yield analysis, growth project activities, application development and extension to support planning and stand management decision-making. Priority 1 is data collection and priority 2 is to address local growth and yield modeling and extension needs.

Year	Activity	Budget	Lead Proponent
2002/03	Maintain stand productivity • permanent sample plot maintenance • Growth and yield modeling and extension	 $25,000 75,000 $100,000	Abitibi
2003/04	Monitor and maintain sample plots and conduct extension	$30,000	Abitibi
2004/05	Monitor and maintain sample plots and conduct extension	$30,000	Abitibi
2005/06	Monitor and maintain sample plots and conduct extension	$30,000	Abitibi
2006/07	Monitor and maintain sample plots and conduct extension	$35,000	Abitibi
	Total	**$225,000**	

5.2.9 Species at Risk and General Wildlife (SSFM)

This purpose of this activity is to provide information about wildlife distribution, status and abundance, and relevant information on the ecology of supporting habitats.

The Planning Group identified the following species as priority wildlife for the Mackenzie TSA: caribou; grizzly; wolverine; mountain goat; stone sheep; fisher; northern long-eared myotis. Priority fish in the Mackenzie TSA include: arctic grayling and bull trout. As part of the five-year implementation plan, priorities will be established for inventory and modeling to ensure that the District's needs are met.

Year	Activity	Budget	Lead Proponent
2002/03	Identify and map red and blue listed species and revise adaptive management model	$400,000	Slocan and Abitibi
2003/04	Identify and map red and blue listed species and revise adaptive management model	$400,000	Slocan and Abitibi
2004/05	Identify and map red and blue listed species and revise adaptive management model	$400,000	Slocan and Abitibi
2005/06	Identify and map red and blue listed species and revise adaptive management model	$400,000	Slocan and Abitibi
2006/07	Identify and map red and blue listed species and revise adaptive management model	$400,000	Slocan and Abitibi
	Total	**$2,000,000**	

5.2.10 Fish and Fish Habitat (SSFM)

Fish and fish habitat inventories provide information about fish distribution and status and about supporting habitats. They range from low intensity overview assessments to detailed species and population inventories (1:20,000 reconnaissance inventories). Considerable effort must also be applied to managing existing information, developing predictive models, and investigating aquatic ecosystem dynamics.

Year	Activity	Budget	Lead Proponent
2002/03	Complete fish and fish habitat management objectives: • data warehouse • inventories	$10,000 325,000 $335,000	Slocan and Abitibi
2003/04	Complete fish and fish habitat management objectives: • inventories • timing windows • modeling	$325,000 50,000 100,000 $475,000	Slocan and Abitibi
2004/05	Complete fish and fish habitat management objectives: • inventories • modeling	$325,000 75,000 $400,000	Slocan and Abitibi
2005/06	Complete fish and fish habitat management objectives: • inventories and modeling ($325,000)	$325,000	Slocan and Abitibi
2006/07	Complete fish and fish habitat management objectives: • inventories modeling ($325,000)	$325,000	Slocan and Abitibi
	Total	**$1,860,000**	

5.2.11 Completion of Sustainable Harvest Obligations (stocking/free-growing surveys) (SH)

This survey program will address Issue #1 and #3 identified in Section 3 of this plan.

Year	Activity	Budget	Lead Proponent
2002/03	Stocking/free-growing surveys	$130,000	Slocan and Abitibi
2003/04	Stocking/free-growing surveys	$70,000	Slocan and Abitibi
2004/05	Stocking/free-growing surveys	$65,000	Slocan and Abitibi
2005/06	Stocking/free-growing surveys	$25,000	Slocan and Abitibi
2006/07	Stocking/free-growing surveys	$25,000	Slocan and Abitibi
	Total	**$315,000**	

5.2.12 Watershed Restoration to 2004 (EEV)

The regional target identified by Forest Renewal BC for watershed restoration is to restore 20% of the very high priority or critical watersheds for fish or domestic water supply values by 2005. Mackenzie's contribution to meeting this regional target is to complete restoration on the Lower Mesilinka, Lower Osilinka, Misinchinka, Nation, and Russell watersheds by 2005.

Year	Activity	Budget	Lead Proponent
2002/03	Continue watershed restoration on five priority watersheds: • restoration plan (Lower Osilinka, Misinchinka) • upslope-riparian-instream prescriptions (Mesilinka, Osilinka, Misinchinka, Nation)	$400,000	Slocan and Abitibi
2003/04	Continue watershed restoration on five priority watersheds: • upslope-riparian-instream prescriptions (Mesilinka, Nation) • routine effectiveness evaluation (Lower Osilinka, Misinchinka)	$400,000	Slocan and Abitibi
2004/05		$0	Slocan and Abitibi
2005/06		$0	Slocan and Abitibi
2006/07		$0	Slocan and Abitibi
	Total	**$800,000**	

5.2.13 Forest Health (SSFM)

This relates to inventories that identify hazard, risk and distribution of major pests. Results are needed for timber supply decisions and to develop higher level plans. Pine stem rust is the priority for Mackenzie.

Year	Activity	Budget	Lead Proponent
2002/03	Develop predictive model for pine stem rust	$35,000	Slocan
2003/04	Finalize stem rust predictive model	$35,000	Slocan
2004/05	Forest health predictive model	$35,000	Slocan
2005/06	Forest health predictive model	$35,000	Slocan
2006/07	Forest health predictive model	$35,000	Slocan
	Total	**$175,000**	

5.2.14 Caribou and Human Disturbance Impacts; Caribou Habitat Supply (Lichen) (SSFM)

In addition to basic wildlife and habitat inventory and development of decision support tools, knowledge building activities concerning caribou management must also include:

1) Investigating lichen response to management and lichen habitat supply; and
2) Investigating human disturbance impacts on caribou, for example snowmobile and aircraft impact. (Note this activity is intended as a contribution toward a broader regional study to be conducted by another organization.)

Year	Activity	Budget	Lead Proponent
2002/03	Caribou information gaps for lichen and human disturbance (e.g. snowmobiles)	$115,000	Slocan
2003/04	Caribou information gaps	$65,000	Slocan
2004/05	Caribou information gaps	$65,000	Slocan
2005/06	Caribou information gaps	$25,000	Slocan
2006/07	Caribou information gaps	$70,000	Slocan
	Total	**$340,000**	

The Mackenzie Forest District has been identified as a suitable location to undertake research relating to human disturbance (including snowmobiles). Given that there is a lower level of human disturbance in the Mackenzie District compared to other suitable locations in the region for conducting caribou research, it provides an opportunity to conduct research which reveals differing levels of causal effects.

The decision to conduct more extensive research on the effects of human disturbance on caribou in the Mackenzie District would require funds in addition to those already allocated to this strategic priority. As well, there may be a need to consider adjusting the timing of research activities to take advantage of animals that are already collared. The decision to increase the level and timing of caribou research activity in the Mackenzie District should be considered by the Regional Caribou Technical Advisory Team. As well, joint funding from other sources to support this type of research should be explored. The outcome of these considerations may result in a future adjustment to this project.

5.2.15 Recreation Inventory (SSFM)

Recreation inventory involves identifying, classifying and recording types and locations of amenity resources including recreation features inventory, visual resources inventory, visual sensitivity inventory, recreation opportunity spectrum inventory as well as inventories of lakes, rivers and interpretative forest sites. There is a 10-year maintenance interval.

Year	Activity	Budget	Lead Proponent
2002/03	Recreation inventory	0	To be determined
2003/04	Recreation inventory	$25,000	To be determined
2004/05	Recreation inventory	$25,000	To be determined
2005/06	Recreation inventory	$0	To be determined
2006/07	Recreation inventory	$0	To be determined
	Total	**$50,000**	

5.2.16 Archeological Overview Assessments (SSFM)

Between 1996 and 2000 Slocan Forest Products and Abitibi Consolidated initiated a project to complete an Archaeological Overview Assessment (AOA) for the Mackenzie TSA. In addition to the usual documentary research and preliminary field reconnaissance necessary to complete an AOA as defined by the Archaeological Assessment Guidelines, the project also included development of a predictive model (Heritage Potential Model). The model was then used to produce preliminary maps identifying the relative potential of areas to contain pre-contact archaeological sites.[6]

Year	Activity	Budget	Lead Proponent
2002/03		$0	Abitibi
2003/04		$0	Abitibi
2004/05		$0	Abitibi
2005/06		$0	Abitibi
2006/07	Complete initial investments in archeological overview assessments (see footnote below)	$20,000	Abitibi
	Total	**$20,000**	

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[6] No funding has been allocated to the completion of the Heritage Potential Model in the current 5-year investment plan since the legal and contractual issues are not expected to be resolved in the near future. If, and when these issues are resolved, funding should be allocated to complete this project as soon as possible.

5.2.17 Visual Sensitivity Objectives (SSFM)

Refer to Visual Landscape Inventory Workplan (see Appendix 2).

Year	Activity	Budget	Lead Proponent
2002/03	Conduct visual sensitivity objectives for high priority areas	$40,000	To be determined
2003/04	Conduct visual sensitivity objectives for high priority areas	$40,000	To be determined
2004/05	Conduct visual sensitivity objectives for high priority areas	$40,000	To be determined
2005/06	Conduct visual sensitivity objectives for high priority areas	$40,000	To be determined
2006/07	Conduct visual sensitivity objectives for high priority areas	$40,000	To be determined
	Total	**$200,000**	

5.2.18 Watershed Restoration 2005-2010 (EEV)

By 2005 initial category I (high priority) watersheds in the Mackenzie District will have been addressed based on the proponents' previous commitment under the Forest Renewal BC program. After this completion of initial watersheds, new category I watersheds like the Philip and Nabesche, become candidates for restoration works. In addition, routine effectiveness evaluation (REE) of works implemented on the original category I watersheds (Mesilinka, Lower Osilinka, Misinchinka, and Nation) will be required for a minimum of two years.

Year	Activity	Budget	Lead Proponent
2002/03		$0	
2003/04		$0	
2004/05	Complete watershed restoration for priority watersheds: • overview Nabesche • overview Philip • REE Mesilinka, Lower Osilinka • REE Nation	$50,000 $50,000 $30,000 $10,000 $140,000	Abitibi and Slocan
2005/06	Complete watershed restoration for priority watersheds: • restoration plans Nabesche • restoration plans (Nabesche, Philip) • REE Mesilinka, Lower Osilinka • REE Nation	$100,000 $100,000 $30,000 $10,000 $240,000	Abitibi and Slocan

2006/07	Complete watershed restoration for priority watersheds: • prescriptions and assessments Nabesche • prescriptions and assessments Philip • REE Mesilinka, Lower Osilinka • REE Nation	 $100,000 $100,000 $30,000 $10,000 $240,000	Abitibi and Slocan
	Total	**$620,000**	

5.2.19 Future Sustainable Harvest Priorities (SH)

The silviculture strategy being developed under Activity 5.2.3 will provide priorities for future sustainable harvest projects which will be implemented under this activity in years 2004/05 through to 2006/07.

Year	Activity	Budget	Lead Proponent
2002/03		$0	
2003/04		$0	
2004/05	Future sustainable harvest priorities	$1,150,000	Abitibi and Slocan
2005/06	Future sustainable harvest priorities	$1,150,000	Abitibi and Slocan
2006/07	Future sustainable harvest priorities	$1,150,000	Abitibi and Slocan
	Total	**$3,450,000**	

6. Annual Performance Measures

A review of the MSRMP will be conducted each year by the Mackenzie TSA RMP Planning Group to determine whether Activity Plan annual performance targets have been met. In addition, TSA objectives and regional targets and RMP priorities will be reviewed to see if there have been any changes.

If annual performance targets have not been met, or have been exceeded, Activity Plans in the MSRMP will need to be adjusted accordingly. Likewise, if TSA objectives or regional targets or priorities have changed or if new information is provided (e.g., results of a silvicultural analysis), strategic priorities and 5-year activity plans may need to be adjusted as well.[7]

A comprehensive performance review should also be conducted every five years to determine whether the desired outcomes (i.e., strategic priorities) in the MSRMP have been achieved.

Based on the annual performance targets identified for each strategic objective category, measures should be established for completing annual performance assessments. These measures should provide an indication of the progress achieved relative to established targets for each activity.

A process for undertaking annual and five-year reviews will need to be established. The process should include indicators for monitoring implementation results and outcomes, criteria for considering new projects and/or proposals and an amendment process for making changes to the MSRMP.

Examples of activities that should be reviewed early in the planning process include:

- watershed restoration program hotspots;
- completion of heritage potential model;
- forest health issues; and
- silviculture type 2 analysis.

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[7] Given the multi-year flow of funding and effort on projects, there may be specific periods (as significant phases of projects are being completed) when a review of funding priorities is most appropriate.

Appendix 1 – Annual Work Plans

Strategic Priority	2002/03	2003/04	2004/05	2005/06	2006/07	Total
1. TRIM II completion	$615,000	$0	$0	$0	$0	$615,000
2. Vegetative resource inventories	$2,030,000	$2,325,000	$2,570,000	$65,000	$150,000	$7,140,000
3. Preparation of silvicultural investment strategy	$20,000	$0	$0	$0	$0	$20,000
4. Caribou management	$600,000	$0	$0	$0	$100,000	$700,000
5. Predictive ecosystem mapping (PEM)	$370,000	$370,000	$60,000	$0	$0	$800,000
6. Interim sustainable harvest program	$735,000	$500,000	$515,000	$470,000	$10,000	$2,230,000
7. Terrain stability mapping	$300,000	$300,000	$300,000	$300,000	$300,000	$1,500,000
8. Growth and yield	$100,000	$30,000	$30,000	$30,000	$35,000	$225,000
9. Species at risk and general wildlife	$400,000	$400,000	$400,000	$400,000	$400,000	$2,000,000
10. Fish and fish habitat	$335,000	$475,000	$400,000	$325,000	$325,000	$1,860,000
11. Completion of sustainable harvest obligations	$130,000	$70,000	$65,000	$25,000	$25,000	$315,000
12. Watershed restoration 2004	$400,000	$400,000	$0	$0	$0	$800,000
13. Forest health	$35,000	$35,000	$35,000	$35,000	$35,000	$175,000
14. Caribou and human disturbance impacts; caribou habitat supply (lichen)	$115,000	$65,000	$65,000	$25,000	$70,000	$340,000
15. Recreation inventory	$0	$25,000	$25,000	$0	$0	$50,000
16. Archeological overview assessments	$0	$0	$0	$0	$20,000	$20,000
17. Visual sensitivity objectives	$40,000	$40,000	$40,000	$40,000	$40,000	$200,000
18. Watershed restoration 2005-2010	$0	$0	$140,000	$240,000	$240,000	$620,000
19. Future sustainable harvest priorities			$1,150,000	$1,150,000	$1,150,000	$3,450,000
Total Budget	**$6,225,000**	**$5,035,000**	**$5,795,000**	**$3,105,000**	**$2,900,000**	**$23,060,000**

Appendix 2 – Background on Key Resource Management Issues in the Mackenzie TSA

Vegetation Resources Inventory (VRI)

The vintage of timber inventories in the Mackenzie Forest District is in excess of twenty years, especially in the northern part of the forest management unit. The southern two-thirds of the TSA were re-inventoried from 1978 – 1992 through depletion and growth updates rather than new field inventories. There was no statistically based ground sampling to verify photo estimates.

Accurate and reliable inventory information is increasingly required for use by decision-making models which will assist land managers in making informed land-base decisions. Current timber and non-timber inventories in the TSA are woefully inadequate to support these decision-making tools and must, as a matter of urgent priority, be completed.

To address these challenges, a VRI *Strategic Inventory Plan* was developed by licensee and agency stakeholders. The *Plan*, prepared by the Ministry of Forests Resources Inventory Branch, was approved on January 10, 2001 and outlines the following phases of VRI activities and products:

1. photo-interpretation over the entire district;
2. timber emphasis ground sampling in the Vegetated Treed area of the district to provide statistically valid timber volumes and polygon-specific tree attributes for the timber supply review in the Mackenzie TSA in 2006 (note: the data set will be required for analysis by 2005);
3. conduct finer polygon delineation and timber emphasis ground sampling in the deciduous stands and mixed-stands to improve species composition descriptions and spatial data for these stands; and
4. install a monitoring program to provide baseline non-spatial data for monitoring the changes and trends over time of timber and non-timber resources, including growth and yield predictions.

Terrestrial and Predictive Ecosystem Mapping (TEM/PEM)

Land managers within the Mackenzie TSA do not have access to data for non-timber resources because they have never been inventoried in a systematic way. Accurate and reliable inventory information is increasingly required for use by decision-making models and to assist with making informed land-base management decisions. Current ecosystem inventories in the TSA are woefully inadequate to support these decision-making tools and must, as a matter of urgent priority, be completed.

In order to address the challenge of inadequate ecosystem information in the TSA, the large-scale mapping project that has been on-going for the past several years will continue on a priority basis. Ecosystem maps, along with associated interpretations, supply valuable information for many uses, particularly planning for resource allocation. The maps are used, for example, to meet many Forest Practices Code-related needs, including landscape unit planning, forest development planning, range use planning and the development and application of biodiversity guidelines, riparian guidelines, and Identified Wildlife Management.

Growth and Yield

There is a high level of uncertainty surrounding growth and yield information in the TSA. Current volume and taper equations (especially for Interior spruce) and decay and waste losses produce inaccurate timber volume results. Further, there is widespread belief that productivity of managed second-growth stands is significantly under-estimated within the TSA.

Opportunity exists to improve growth and yield monitoring by observing the growth and yield of a forest and comparing this with the predicted growth and yield of the same forest to assess risk and uncertainty around predictions. Growth and yield monitoring complements and adds value to Vegetation Resource Inventories (VRI).

The following growth and yield 'needs' require monitoring:

- Volume and taper equations that:
    - reflect losses due to decay and waste; and
    - form changes due to varying treatments.
- Net volume adjustment.
- Estimates of site quality, including:
    - SI estimates from BEC;
    - SI estimates from growth intercepts;
    - adjustment of old growth site indices; and
    - site/height curves.
- Stand growth resulting from:
    - stand establishment scenarios;
    - incremental silviculture treatments; and
    - harvesting options.

In addition, interactions between treatments, sites, species, timing of treatments and prior treatments should also be monitored, including:

- Pest impacts on stand growth and yield, including interactions with stand establishment, tending, and harvesting treatments.
- Characteristics of wood quality (low priority).
- Detailed management level inventory, including:
    - long term inventory projection, with projections of successional change (low priority);
    - biodiversity;
    - growth and condition of non-commercial vegetation;
    - quantity and distribution of coarse woody debris; and

  - predictions of stand attributes related to non-timber resources.

Forest Health

Forest pests and diseases account for significant productive volume loss in both mature and developing timber. Recent infestations include:

- bark beetles (spruce, lodgepole pine and balsam fir) in mature timber;
- budworm (spruce and balsam fir) in mature timber;
- stem rusts (western gall rust, comandra blister rust, stalactiform blister rust) in immature pine stands; and
- weevils (root collar weevil, spruce weevil) in plantations.

Opportunity exists to improve our understanding of forest pests and diseases through overview assessments and development of predictive models so that strategies to reduce timber volume losses to pests and disease can be formulated.

Pine Rust

There is a lack of specific pest management decision-support tools to address issues relating to lodgepole pine rusts.

Hard pine stem rusts cause more damage to lodgepole pine throughout the BC interior than any other diseases. The hard pine stem rusts are caused by a well-delineated group of rust fungi, which cause similar and inconspicuous symptoms. Damage from these rusts may cause significant economic impacts in our forests by killing trees, causing stem distortions, or by reducing growth. The three rusts of concern are the Western gall rust (***Endocronartium harknessii***) (WGR), Cromandra blister rust (***Cronartium comandrae***) (CBR), and Stalactiform blister rust (***Cronartium coleosporoides***) (SBR).

Knowledge gaps that have been identified fall into six broader topics:

(1) progeny testing for Pl susceptibility to infection;
(2) natural disturbance and Pl regeneration;
(3) acceptable management practices;
(4) ecology of the pathogens;
(5) standard hazard/risk/susceptibility rating system at the stand and landscape levels; and
(6) timber supply impacts of hard pine stem rusts.

The knowledge strategy is based on three key principles:

- For forest health issues, a good workable answer today is better than waiting ten years or more for the perfect answer.
- To verify the status (quantity and applicability) of our knowledge base, it is important that the strategy involves a re-analysis of existing bodies of information, and more effective use of existing information.

- The status of our knowledge base will be utilized to identify knowledge gaps and to focus on new information requirements.

Some of these questions will address short-term issues but others will require longer-term assessment. We can undertake short-term analyses and modeling exercises using existing information and new information as it is produced. Answers to long-term questions will need long-term installations.

Sustainable Harvest (Backlog Silviculture and Enhanced Forestry)

This section identifies the key Sustainable Harvest issues[8] facing the TSA (as perceived by the Mackenzie Planning Unit Group), as well as the opportunities that exist considered suitable to address them.[9]

***Issue #1:* Uncertainty in the status of the Pre-87 logging and fire disturbed landbase**

The estimates of Pre'87 backlog area in the TSA is 395,000 hectares or 14% of the Crown forest. This would account for up to 27% of the THLB under an assumption that all fire origin Pre'87 stands lie within THLB – a possibility which has neither been confirmed nor explored. TSR 2 Analysis accounted all NSR and backlog impeded sites as contributing to the timber supply of which 60% are classified as managed stands and 40% as unmanaged. Some facts about backlog inventory based on 1995-1998 aerial photo assessments:

- 63,000 ha of the backlog inventory has yet to receive some form of stocking survey to confirm production status;
- 70,000 ha classified as a potentially free growing; and
- 254,000 ha of the Pre'87 fire origin land base are of unknown timber production status.

Opportunity:

Conduct an accelerated stocking/free growing assessment to maintain up to date information on land status and brushing treatment needs. It is expected that the VRI program, to a certain extent, would address this issue.

***Issue 2:* Loss of productivity on backlog NSR**

Backlog NSR includes all areas logged or otherwise disturbed prior to October 1, 1987 which are, in the district manager's opinion, insufficiently stocked with healthy well spaced trees of a commercially acceptable species. Using provincial net-down procedures, 22,450 hectares of backlog is classified as "uneconomical", "inaccessible" or under some "biological constraint", and likely will not be reforested. 4610 hectares is potentially treatable given the above mentioned constraints. All treatable backlog was, for the purpose of TSR 2 Analysis, considered as a current NSR with 3 year regeneration delay and species assigned from ISIS.

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[8] The issues are not listed in order of priority.

[9] The complete list of issues identified through Silviculture Analysis Type 1 is available on the Ministry of Forests website (**http://www.for.gov.bc.ca/hfp/silstrat/pdffiles/pgeorge-tsa-mack-t1.pdf)**

Opportunity:
At a later date, the ground survey is required on those 4610 hectares to determine which areas are good investments and which are not.

Silviculture Analysis Type 1 identified backlog reforestation as a highest priority for the interim period (2000 and 2001) in order to implement planting on all sites which have been under an approved prescription and sowing request for trees. After that period, activities on backlog reforestation will be temporarily ceased until Type 2 Silviculture Analysis completion.

***Issue #3:* Loss of productivity on impeded stands**
Many of the backlog stands are impeded by broadleaf vegetation, and therefore may be producing coniferous timber at a rate lower than assumed (unmanaged stands – see issue #1). Based on 1995-1998 aerial photo assessments, up to 32,000 hectares of the logging origin backlog stands require some form of impeded stand release from broadleaf competition. However, the highest priority for brushing lies in stands that have been restocked in the last five years. This follow-up intervention constitutes a legally binding silviculture obligation.

Opportunity:
As these impeded stands develop, opportunities that now exist to improve production will be foregone. For example, some stands will be at age 50 within the next 20 years, when treatment response is minimal if any. Further, on the ground survey is needed to classify "older" backlog stands and determine those with highest priority for treatment.

***Issue #4:* Managed Stand Pathogens and Pests**
Regenerated lodgepole pine offer enormous timber production potential in the TSA. Unfortunately, the species also suffers from a plethora of juvenile stand pests, the most serious of which are lethal infections of any of the three species of pine rusts. Lodgepole stem rust damage may be managed through silvicultural interventions.

Opportunity:
Locally developed silviculture regimes and tactics are needed to minimize the impact of pine rust diseases. Some of the information gaps which should be addressed are:

- What is the volume growth impact of various infection levels of each rust species;
- What is the relationship between local geography and rust infections risk? Pine rust hazard mapping will improve the efficiency with which problem stands are identified, surveyed and treated;
- What level of lethal infection can be tolerated when density management interventions are planned for a stand?

***Issue #5:*Orchard Seed Availability**
Use of the class A seed or seed of the highest genetic worth is considered the best silviculture investment on most sites largely due to a low per hectare cost. However, the

availability of select seed in most cases is in short supply to satisfy needs in most seed planning units.

Opportunity:
In coordination with the Tree Improvement Branch, through appropriate measures, ensure that existing seed supply and orchard seed production meet current or projected local reforestation needs.

Issue #6: **Operational Planning and Completion of Type 2 Silviculture Analysis**
Many high priority brushing activities not completed in 2001. Problems associated with possibly outdated prescriptions and their approval must be resolved. Creation of the Pesticide Use Permit or Pest Management Plan for Backlog Program and "ownership" issues must be resolved if the brushing program is to continue.

Silviculture Analysis Type 2 is an in depth forest level analysis designed to develop silviculture strategies and identify funding needs. Analysis will show the effect of various funding levels on timber supply as well as funding level for the preferred management scenario.

Opportunity:
It is essential that operational planning for this activity resume in 2002/2003 to ensure effectiveness and efficiency of backlog brushing investments.
Complete Type 2 Analysis and define a new silviculture investment strategy for the Mackenzie TSA.

Overview of Timber Supply Issues

Recently completed Timber Supply Analysis (Aril 2001) shows that there is no short or medium term impact on timber supply. Therefore, the Mackenzie TSA RMP Planning Group feels that the highest priority and greatest opportunity for the Mackenzie TSA lays in investments which will address information gaps and outdated inventories for the next TSR (Sustainable Forest Management Program). This will require a substantial reduction in the Sustainable Harvest Program. The key issues and potential silviculture strategies identified in the last year's RMP remain unchanged. The only difference is that such activities would address potential increase in timber supply rather then alleviate potential downfalls over the planning time horizon.

The Planning Group recognizes the need to revisit and adjust such decision in lieu of new information, funding, and potential FRBC re-organization.

The objective of the sustainable harvest program is to increase the volume, economic value, and health of second-growth forests; maintain and enhance habitat supply; increase the amount of land available for commercial timber production; and support more informed silviculture investment decisions.

The Sustainable Harvest Program is developed with consideration given to the Timber Supply Review, Mackenzie LRMP, and Silviculture Analysis Type 1.

Timber supply is defined as the amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime. It depends directly on how the forest is managed for both timber and non-timber resources and values.

Sustainable harvest investments are targeted at both the volume and value of second growth timber that will be available for future harvest.

All participants at the Mackenzie Planning Unit Table agree that the relative benefit of silvicultural investments is difficult to measure unless they are viewed within a broader forest management context. Forest analysts and practitioners agree that silvicultural treatment of forest land is essential for ensuring the continued existence of a timber supply. Exactly how much treatment is necessary has been a question of constant debate and an extremely difficult task. Sound silviculture budget planning requires much more detail in specifying timber production, both quantity and quality, wildlife habitat supply and other non-timber objectives. Silviculture Analysis Type2, forest level spatial analysis currently underway, is a first attempt to provide a clear linkage between the higher level "strategic" objectives and operational activities that will be derived from such analysis.

The results of Type 2 Silviculture analysis will be incorporated into next year's RMP submission.

The Sustainable Harvest component of the 2001-2005 RMP for the Mackenzie TSA identifies resource supply issues, and recommends appropriate strategic and tactical silviculture investments required to address those issues.

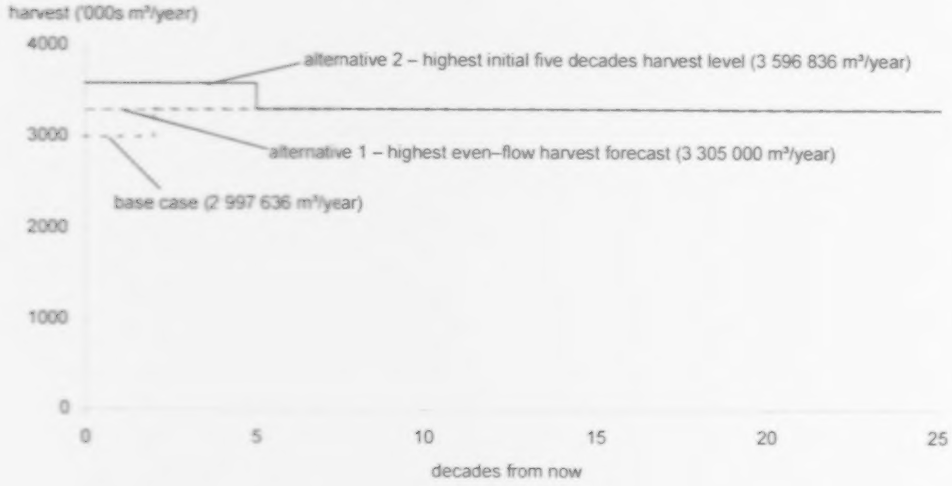
Sustainable Harvest information, issues and opportunities in the 2002-2007 RMP is therefore largely based on the previous year's RMP submission and Silviculture Analysis Type 1 (non spatial workshop based analysis).

Since the last Timber Supply Review, and with the TSR 2 Analysis Report released in April 2001, some changes that influence forest management have occurred. Some of the most significant are: reclassification of the operability map, government approval of Mackenzie LRMP, establishment of protected areas, interim landscape units and biodiversity emphasis options. The current timber harvesting land base (THLB) is 25% larger than in the last TSR. The major factor in increasing the THLB is the reclassification of land which was previously considered inoperable. The results of this timber supply analysis suggest that, using current inventory and timber growth information, the current AAC in the Mackenzie TSA could be maintained for two decades before it could be **increased** to a steady level of 3 305000 m^3/year for the remainder of the analysis period (250 years).

The analysis further compares the two alternative forecasts with the base case (page 24, 2001 Analysis Report):

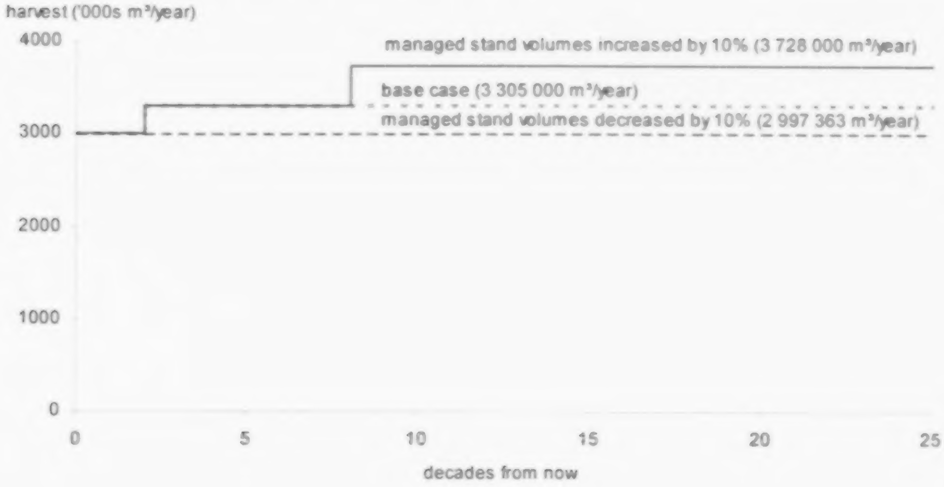
Alternative 1 – highest even-flow

Alternative 2 – highest initial five decades harvest level



In both forecasts, the medium and long-term harvest levels are 10% higher than the current harvest level with no declining timber supply in the short term. Consequently, this eliminates the **“declining timber supply in the short and medium term”** issue identified in last year's RMP submission.

Further, because of the limited experience and data that are available for regenerated managed stands, sensitivity analysis was performed to determine the level of impact of this uncertainty on the base case. It shows that if the regenerated stand yields are decreased by 10%, current harvest level can be maintained for the whole planning horizon, while long term harvest level would be 12% below the base case.



The analysis indicates also that medium-term harvest level is most sensitive to uncertainties in the forest inventory used to estimate timber volumes (i.e. estimated tree heights and stand ages). Preliminary analysis suggests that the existing inventory may overestimate volumes by more then 10%, but further assessments are needed to verify results.

Taking into consideration all of the above and a number of other associated uncertainties not mentioned here, Mackenzie Planning Unit Table feels that the highest priority and greatest opportunity for the Mackenzie TSA is to invest in activities that will address information gaps and outdated inventories for the next TSR (Sustainable Forest Management Program). This will require a substantial reduction in the Sustainable Harvest Program. The key issues and potential silviculture strategies identified in the last year RMP remain unchanged. The only difference is that such activities would address a potential increase in timber supply rather then alleviate potential downfalls over the planning time horizon.

The Mackenzie Planning Unit Table recognizes the need to revisit and adjust such decisions in lieu of new information, funding, and potential FRBC re-organization. For that reason, the following will constitute the Interim Sustainable Harvest strategy for the Mackenzie TSA:

Define a new Silviculture Investment Strategy through the following activities:

- completion of Silviculture Analysis Type 2;
- resolution of local administrative, planning and implementation issues; and
- optimal versus future funding level and associated uncertainties.

As part of the Silviculture Investment Strategy there will be a need to conduct an accelerated stocking/free growing assessment to maintain up to date information on land status and brushing treatment needs. Concurrent with surveys, if treatment is needed, there will be a need to prepare appropriate prescriptions in accordance with the current legislative and Ministry policy requirements applicable for Backlog Program.

To facilitate achievement of free growing status, some blocks will require inclusion of deciduous species. Deciduous species may become more important in the future wood supply, and to dismiss its value based on present market conditions reduces future management options.

There will also be a need to conduct brushing treatments on high risk stands to protect past investments, and ensure that existing plantations remain Satisfactorily Restocked (SR), achieving free growing status as early as possible. The highest priority for treatment will go to the most recent investments targeted to Backlog NSR reforestation (basic legal obligation).

Baseline Resource Mapping

The TRIM II program provides updated topographic maps showing accurate locations of roads, landings, seismic lines, etc. TRIM II provides improved resolution and accuracy in capturing the presence of smaller streams and topographic contours. Digital orthophotos are also provided by the program; orthophotos can be used as a landscape view in support of maps and other thematic products generated from photointerpretation.

The TRIM II Base Map is designated as the "common" base map in the Prince George Forest Region for registering resource data. This policy, supported by major licensees (forest industry) and government agencies, ensures efficient electronic exchange and sharing of spatial data.

The Regional Technical Planning Committee advocates completion of the TRIM II program as an important keystone technology for addressing Sustainable Forest Management resource issues. Completion of the program in the Mackenzie TSA is therefore of the highest and most immediate priority in view of the intent to implement VRI investments in 2002/03.

Caribou

Stakeholders in Mackenzie have undertaken a multi-year project "Ecological Factors Affecting Northern Caribou in the Omineca Region, BC" to address caribou and caribou habitat, for which resultant information and decision support tools may be applied in other parts of the Omineca-Peace region. The vision adopted throughout this project has been "to provide a comprehensive inventory of caribou and habitat values that through decision modeling, is used to aid strategic, land-management in the TSA allowing for sustainable resources management (LRMP), but also could address industrial certification initiatives, COSEWIC recovery plans for threatened species, and timber supply reviews" (McNay, 2001).

The objectives for this project remain as they were initially stated (McNay 1999) and are repeated here for context:

- provide basic inventory information concerning abundance, seasonal movements, and habitat needs of large ungulates where such basic information could then lead to better assessments of habitat values for these species;
- provide standard expressions of, or procedures for verifying, Wildlife Habitat Assessments where increased confidence in these assessments could then lead to better strategic planning for integrated management of forests and wildlife;
- develop, implement, and monitor a strategic management plan for Caribou (i.e., Mackenzie's LRMP's "Caribou Management Strategy"); and
- aid subsequent development of, and discussion about, adaptive management initiatives with industry, government, First Nations, and local communities within the Mackenzie Forest District.

Wildlife and Wildlife Habitat

Filling the knowledge gaps listed below would substantially improve decision making by introducing more certain and complete basic information/data, enable the development of management options and empower a much more accurate evaluation of the implications of management decisions through:

- filling specific information gaps on life history, habitat requirements and sensitivities of specific species;
- improving our understanding of certain wildlife species' and habitats' sensitivities to forest development activities;
- developing data tracking systems that enable data compilation, analysis and data sharing;
- developing accessible and useable predictive models; and
- monitoring the implementation of existing wildlife management strategies.

Improving the completeness, reliability, and consolidation of wildlife and wildlife habitat information for species at risk and general wildlife is a high priority for the Mackenzie District, and all Forest Districts in the Omineca-Peace region. The ability to establish clear and measurable management objectives for species and habitats is a prerequisite to achieving sustainable forest management. Addressing wildlife and wildlife habitat through either collection of additional inventory, consolidation of existing information, or the development of predictive decision support tools, is supported by the local LRMP, and is recommended as a means of clarifying future timber supplies, and obtaining forest certification. Beyond this, as stewards of the land, the government agencies and forest licensees together share a common responsibility for managing our wildlife resource to ensure populations and habitat features both at the stand and landscape level are considered and conserved.

Increasing our understanding of species distribution, abundance, and life history is required as baseline information, which is needed to address and manage for species at risk and general wildlife. Knowing about habitat requirements of the species, and being able to predict habitat selection with some degree of certainty is required to ensure potential adverse impacts on species from development and other human caused disturbances can be minimized.

At the Regional RMP level, a list of threatened and endangered species along with general wildlife (moose, elk, deer, pine marten, stone sheep, mountain goat, goshawk, and waterfowl) have been identified and prioritized with recommendations for knowledge building activities. The Mackenzie TSA RMP Planning Group has selected from this regional list those species which are applicable to their district in terms of unique opportunities, expectations, or concerns. For example, **Arctic Grayling** are red-listed Provincially and are of high priority. Fish/habitat specialists and practitioners agree that specific attention to watersheds that drain into the Williston reservoir is critical in learning more about Arctic Grayling ecology (the most noticeable change in fish populations has been the almost total disappearance of Arctic Grayling in the Williston Basin). Thus, Mackenzie has a unique opportunity due to the very nature of the landbase to make efforts towards addressing this species.

Following from the above example, the section below briefly lists the species at risk and general wildlife that the Mackenzie TSA RMP Planning Group has included in this RMP and the corresponding rational.

Bull Trout

An overall objective for bull trout (blue listed species) is to conserve the abundance and diversity of naturally occurring populations and habitats and to maintain/enhance habitat. Building upon existing information gathered from studies performed around the region and elsewhere, quantify long term population trends (declining, maintaining or increasing), determine the regional population distribution and the management implications of unique life history patterns in identified watersheds. Geographical sensitivities to harvesting and angling are pronounced in Mackenzie (Williston) and thus, the District is required to play a role in filling the knowledge gaps associated with managing for this species.

Wolverine

Wolverine are wide-ranging forest carnivores that are on the Provincial Blue List, meaning that this species is vulnerable. They require large tracts of habitat, have low reproductive rates, poor juvenile survival, and exist in relatively low densities. Little inventory data, with the exception of a 5-year investigation in the Mackenzie Forest District in the Omineca-Peace Region, and a 6-year project in the Kootenay region of southeast British Columbia, is available for wolverine. The Northern Wolverine Project in Mackenzie was conducted from 1996 to 2001 by the Ministry of Environment, Lands and Parks. In order to incorporate the only currently available and suitable information into Forest Development Planning, the first and most important activity is to facilitate the completion of data analysis and reporting for the Mackenzie Northern Wolverine Project.

Although the field portion of the Mackenzie Northern Wolverine project is finished, final reporting and analysis are not yet complete. Since the information from this study is most applicable to the region, it should be the first order of business to extract the relevant information from the project and translate this into planning language and guidelines.

Grizzly Bear

Grizzly bears are provincially Blue Listed, Identified Wildlife, and are a species of special concern at the national level. In order to adequately manage and conserve grizzly bears, information on population characteristics and habitat requirements is needed. There is currently little information upon which to base grizzly bear management decisions, and there is little population or habitat inventory for grizzly bears in Mackenzie and all of the Central Interior of BC, where the most intensive resource extraction activity is timber harvesting. A broad objective in the sustainable management of grizzly bears is to obtain population and habitat inventory data, and to extrapolate to other areas. Investigations should include obtaining population density estimates, reproductive rates, mortality rates, identifying seasonal habitat-use patterns and critical habitat types, determining seasonal movements, home ranges, food habits, and using this basic information to develop predictive habitat use models.

(Footnote: Stakeholders in Mackenzie have expressed that their District focus could be on building decision support tools for grizzly in an adaptive management modeling approach similar to that developed in their caribou project "Ecological Factors Affecting Northern Caribou in the Omineca Region, BC".)

Fisher

Fishers are Identified Wildlife, and Blue Listed, (vulnerable); they are considered to be habitat specialists, fulfilling most of their life requirements in forested habitats. Because of an association with late-successional forests, forest harvesting activities can have a detrimental effect on fisher populations by altering and degrading the abundance and distribution of the resources and habitat features they require. An objective is to collect information and develop guidelines and tools to facilitate the management and conservation of fishers and their habitat in the forested landscapes of the Omineca-Peace Region. A 5-year inventory project examining the ecology of fishers in sub-boreal landscapes of the Peace River Drainage of the Mackenzie Forest District was conducted from 1999-2001 by the Peace/Williston Fish and Wildlife Compensation Program (PWFWCP)(Weir, 2000).

Northern Long-Eared Myotis

Relative to our state of knowledge on other species at risk, virtually nothing is known about the habitat, population status and distribution of the Northern Long-Eared Myotis in Mackenzie, and the entire Omineca-Peace Region. Inventories of distributions and habitat use are needed to enable managers to predict and follow up on occurrences.

Mountain Goat

Mountain Goats reside in various locations within the Mackenzie TSA and the Mackenzie TSA RMP Planning Group supports inventory efforts of goat distribution and abundance. Biologists need to conduct census, assess population status, investigate habitat use, and identify high value goat habitat. The location of mineral lick sites can be a primary factor in goat distribution. This has significant ecological consequences in terms of forage availability, predation, and potential impacts from forestry activities and other development. The spatial distribution of licks with respect to available forage and escape terrain is a critical habitat requirement for goats and mineral licks. Therefore, mineral licks, typically in low elevation habitats need to be identified and protected.

Stone Sheep
The Mackenzie LRMP incorporates focusing some efforts on Stone Sheep in certain resource management areas. The Mackenzie TSA RMP Planning Group supports activities to identify high value stone sheep habitat.

Habitat Features
The Mackenzie TSA RMP Planning Group agreed that, as per LRMP recommendations, it is important to identify significant habitat features to enable management/maintenance of these features across the landscape. The development of a system is required (an additional data field in an existing dataset or a new system) that tracks priority resource features (i.e. mineral licks, game trails, rutting areas, natal areas and seeps) as they are identified. Identify travel and connectivity corridors to be managed within the context of landscape level planning.

(Footnote: The species and activities above are not listed in order of priority)

Fish and Fish Habitat

Knowledge of fish distribution and fish habitat will ensure that appropriate riparian management practices and road development are planned for and implemented. Increased fish distribution knowledge will also target populations of 'identified wildlife' (bull trout and potentially arctic grayling) for consideration under the Forest Practices Code Identified Wildlife Management Strategy. Filling these knowledge gaps and making data more accessible to resource planners and users would substantially improve decision making by introducing more certain and complete basic information/data, enabling the development of management options and allowing a much more accurate evaluation of the implications of management decisions. Thus, work is needed in the following general areas:

1) Fish Inventory: In Mackenzie, overview, reconnaissance, life history, and population inventory information needs to be completed. Gaps in reconnaissance inventory exist in all forest districts across the region, but are largest in Mackenzie, Fort St James, and Robson Valley. When prioritizing watersheds for further inventory work, the sensitivity of the watershed and its fish species, the cumulative and planned development and direction from other plans need to be considered.

2) Data Management: In addition to collecting additional information on fish and fish habitat through inventory, it is critical to consolidate and manage the data and information we already have. This is especially true to prepare data for input into predictive models. A key task will be to ensure that all data are formatted appropriately for input to predictive models (i.e. complete phase 1-3 reconnaissance

inventory, new inventory and TRIM watershed atlas) – this will require related project investments.

3) Predictive modeling: the use of predictive models to determine fish distribution and habitat capability in unsampled areas will greatly enhance fisheries management and strategic planning over the landbase. Inventory costs will be reduced and the risk associated with predictions can be measured, thereby reducing uncertainties associated with management decisions. The Fish Habitat Assessment Tool (FHAT20) is one decision-based modeling tool used to aid the prediction of riparian classification for the purposes of managing riparian areas as part of the Forest Practices Code of British Columbia. Implementation of this management tool can provide structure and efficiency to a currently "loose" decision-making process and using the tool through a Local Area Agreement between Forest Licensees and Government could provide for reductions in the cost of inventory associated with riparian classification. Other benefits from implementation would accrue to certification efforts through the consistent processing of recorded information about management decisions. Also permit processing (e.g., Silviculture Prescription and Road Permits) through efficient information transfer to government agencies would be a benefit.

4) Understanding Aquatic Ecosystem Dynamics: A number of research projects could be designed to address the broad knowledge activity of improving our understanding of aquatic ecosystem dynamics. The regional RMP recommends that understanding the interaction between forest development activities and aquatic ecosystems is of primary interest for sustainable forest management. In particular, managers require information regarding the impacts on watersheds from road development and development density. In Mackenzie a better understanding of aquatic ecosystems and fish species life history is needed to refine timing windows of in-stream works.

Traditionally in the District, the identification of fish streams has been very "piece-meal" and has not involved much strategy in the inventory process (e.g., operational inventories have tended to focus on streams adjacent to cut-blocks without regard to broader watershed characteristics; inventories have tended to be site or watershed dependent and do not address broad landscape operating area contexts). Under the umbrella of understanding aquatic ecosystems Mackenzie stakeholders recommend conducting work on "main stems" of watersheds to address timing windows for in-stream works. In managing stream crossings, in-stream works windows vary widely between streams being used by fall spawners and those streams that are not used. There is a need for fish and fish habitat data for suspected bull trout, arctic grayling and mountain whitefish watersheds to gain more knowledge regarding the distribution of these species known to require fall spawning sites. Data collected would enter into modeling to help identify appropriate slope gradients to use as barriers, and to set appropriate timing windows for watershed specific areas.

Watershed Restoration

The Watershed Restoration Program was initiated under Forest Renewal BC's third strategic objective: "Enhancing Environmental Values", and inherent in this program are targets for restoring high priority watersheds across the region. To appreciate this objective, one must understand what is meant by a critical watershed. Forest Renewal BC with assistance from Ministry of Environment developed a procedure to categorize watersheds through the development of a regional watershed benchmark. This benchmark represents a ranking of watersheds across regional areas based on fish and/or domestic water supply values.

Watersheds were identified in 1 of 6 categories based on their history of resource development.[10] The following summarizes the 6 categories:

Category I: watersheds have known impacts from pre-FPC forestry that will potentially benefit from restoration activities.
Category II: watersheds have impacts from pre-Code forestry as well as other land uses (including private land) and where there is a coordinated restoration plan in place.
Category IIB: watersheds with significant impacts from other land use (including private lands) but where there is no coordinated restoration plan in place.
Category III: watersheds with minimal or no pre-FPC forestry impacts.
Category IV: watersheds that have been impacted to such a degree by pre-FPC forestry that restoration effort is unlikely to be successful or cost-effective.
Category V: watersheds with insufficient information to determine their status of impact.

Watershed Restoration Priorities for the Mackenzie District by 2005

The regionally strategic target identified by Forest Renewal BC for the EEV's WRP component is to restore 20% of the Very High priority or critical watersheds for fish or domestic water supply values by 2005. Mackenzie's contribution towards meeting this regional target is to complete restoration on the Lower Mesilinka, Lower Osilinka, Misinchinka, Nation, and Russell watersheds by 2005 to meet Forest Renewal's strategic target.

As a component of the Mackenzie RMP, the commitment to meet the 2005 watershed restoration targets has been confirmed and a future commitment of addressing new category one watersheds will be addressed between 2005-2007 (i.e. Philip watershed). The Mackenzie RMP recognizes the importance of evaluating restoration works to ensure that the current techniques and implementation practices are effective. Therefore, a component of completing WRP works is to complete the follow-up restoration activities for a minimum of 2 years after implementation.

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[10] Watersheds were assigned categories based on consultation with Ministry of Forests, Ministry of Water, Land, and Air Protection, and licensees

The investment priorities and implementation plan within the Mackenzie RMP does not specifically address WRP "Hot-Spot Issues". In the context of WRP, hotspots mainly refer to stream crossings (typically culverts) that block fish passage, and road failures or landslides attributable to pre-FPC forest harvesting activity. Although there is no funding explicitly set aside for these issues, the Mackenzie TSA RMP Planning Group acknowledges the importance and need to incorporate hot spot WRP issues on an annual basis to either address works in non-priority watersheds, or to implement fish culvert passage and hillslope instability problems.

Archaeology

In 1996, TimberWest (now Slocan Forest Products Ltd.) initiated a project to complete an Archaeological Overview Assessment (AOA) for the Mackenzie TSA. In addition to the usual documentary research and preliminary field reconnaissance necessary to complete an AOA as defined by the Archaeological Assessment Guidelines, the project also called for the formulation of a predictive model (Heritage Potential Model) and implementation of the model to produce preliminary maps identifying the relative potential of areas to contain pre-contact archaeological sites.

The Archaeological Overview Assessment Report was completed and submitted to the Ministry of Small Business, Tourism and Culture in the spring of 1997. The Heritage Potential Model was developed based on criteria such as slope, aspect, forest cover type and distance from water. However, the preliminary maps produced through implementation of the Model were of such a scale and low statistical significance that they were of little use for forest resource management planning in a TSA of over 6 million hectares in size. It was anticipated that the statistical validity of the Model could be increased through additional field sampling, therefore in the summer of 1997 Finlay Forest Industries Inc. (now Abitibi-Consolidated Inc.) initiated a two-year project that included for the field sampling of an additional 80 sites across the TSA and the development of a dynamic GIS based predictive model that could be updated with additional or new base data as it became available.

The field component of the project was completed satisfactorily and reports submitted to the Ministry of Small Business, Tourism and Culture in 1999. However, for various contractual and legal reasons, work on the predictive model was not completed. Stakeholders in the TSA recommend that once the legal and contractual issues are resolved that completion of the modeling work should be identified as a high priority. It is estimated that a final investment of approximately $20,000 will be required to bring this project to a satisfactory conclusion.

Note for the Activity Plan

No funding has been allocated to the completion of the Heritage Potential Model in the current 5-year investment plan since the legal and contractual issues are not expected to be resolved in the near future. If, and when these issues are resolved, funding should be allocated to complete this project as soon as possible.

Visual Quality

A visual landscape inventory work plan was completed for the Omineca-Peace region in 2001. The work plan provides cost estimates and prioritization for acquiring new data over the next 5 years. A listing of the viewsheds, priority and target completion date is provided in the following table.

Geographic Area (Viewshed) Name	Priority	Target Completion
Aiken Lake	4	2005
Baby Lake	To be re-assessed in 5 years	
Baldy Trail	4	2004
Barrier Pass	2	2003
Braid (Sheep) Creek/ Kechika River. confluence	To be re-assessed in 5 years	
Burden Lake	2	2003
Butternut Lake	4	2005
Canty Lake	4	2005
Citreon (Big) Ck./Kechika River. confluence	To be re-assessed in 5 years	
Clearwater Lake	4	2005
Curve Lake	4	2005
Cut Thumb Bay	1	2002
Dina Lake #1	1	2002
Discovery Creek	1	2002
Driftpile Lake	To be re-assessed in 5 years	
Duckling Creek	1	2002
Ed Bird – Estella Lakes	1	2003
Finlay Bay	1	2003
Finlay River	To be re-assessed in 5 years	
Fort Ware	1	2003
Fox Lake	3	2004
Frog River	To be re-assessed in 5 years	
Gataga River	To be re-assessed in 5 years	
Germansen Mountain	4	2005
Germansen/Omineca Corridor	To be re-assessed in 5 years	
Heather Lake	3	2004
Herchmer Pass	3	2004
Highway 39	1	2002
Highway 97	1	2002
Johiah Lake	5	2006
Kechika River (inc. Davie Trail)	5	2006
Klawli Lake	4	2005
Mackenzie Townsite (inc. Morfee Lakes)	1	2002
Manson Creek Community	3	2002

Manson Lakes	1	2002
McIntyre Lake	4	2005
Nation River	2	2003
Nina Lake	4	2005
Obo Lake	To be re-assessed in 5 years	
Obo River	To be re-assessed in 5 years	
Osilinka Lakes (aka "Big Big and Little Big Lakes")	5	2006
Peace Reach (inc. entire Peace Reach viewshed area)	3	2003
Pelly Lake	1	2003
Philip Lakes	1	2003
Sabai Lake	4	2005
Shadow Lakes	1	2002
Shadow Lk. Camp Area	1	2002
Shoal Lake	1	2002
Sifton Pass	To be re-assessed in 5 years	
Spinel Lake	5	2006
Thutade Lake	3	2004
Tobin Lake	3	2004
Toodoggone Lake	4	2005
Toodoggone River (to the confluence of Finlay River)	4	2005
Tsay Keh Village	1	2003
Tsaydachi Lake	4	2005
Tudyah Lake	4	2005
Tutizzi Lake	2	2002
Twenty Mile Creek	1	2002
Unnamed area southwest of Warneford/Kwadacha Forks	5	2006
Unnamed Lake (West of Obo Lake)	To be re-assessed in 5 years	
Uslika Lake	3	2004
Viewshed from 10 Mile and 14 Mile (along Germansen Landing Corridor)	To be re-assessed in 5 years	
Wasi Lake	4	2005
Weissener Lake	5	2006
Wolverine Lakes	3	2004

Recreation

A priority for the Prince George Forest Region is to conduct a review of the state, condition and accuracy of recreation features inventories within the region. In essence this is a knowledge gap identification process to determine which areas of the region has substandard recreation features inventory. In order to demonstrate that the resource is being managed for multiple resource values and that good land stewardship is practiced, all locations of significant and important recreation features should be mapped. These important features include thermal springs, white water classes, canoe routes, waterfalls, caves, karsts, unusual or rare rock or mineral deposits and historical sites. These are all physical features, which once mapped are unlikely to change.

A recreation features inventory exists for the region. A review is required to determine whether it is complete and accurate. Comments from district staff and other local experts indicate that features are missing. Such features as caves and karsts are extremely difficult to inventory as their locations are hidden from view and require input from local experts. Less populated areas with limited access are most likely where the recreation features inventory requires update and improvement.

Activities to be undertaken to complete a recreation features inventory include:

- review existing Recreation Feature Inventory and consult District and Region Staff and local experts from outdoor recreation clubs and guide outfitters for accuracy and completeness;
- identify areas where knowledge gaps exist and where improvement is required; and
- evaluate what tools for mapping are available and which local experts to consult for input.

In setting priorities it will be important to consider wilderness areas adjacent to recently created Parks and Protected Areas arising from LRMPs.

All recreation feature locations will be registered to TRIM base maps. Mapping symbology will follow RIC standards. The information will reside in the public domain (Corporate Database) and will be available upon request.

The identification of Recreation Features is extremely useful for Visual Landscape Planning.

Archaeological Features and Sites are related to Recreation Features but due to their very sensitive management archaeological features are planned separately. As well, natural recreation features are often of archaeological significance.

Karsts are also significant geological formations, which are linked to terrain mapping.

Appendix 3 – Regional Output Targets and RMP Priorities

Regional investment priorities for each of the Forest Renewal BC's strategic objectives (SH, EEV, SSFM) were reviewed and those that applied to the Mackenzie TSA were used to guide the development of the MSRMP.[11]

A summary of regional investment priorities for each of the Forest Renewal BC land and environment based strategic objectives is as follows.

Strategic Objective	Output Target
Strengthening Sustainable Forest Management	
• Incomplete caribou management objectives	• targets established annually
• Lack of species at risk management objectives	• targets established annually
• Lack of general wildlife management objectives	• targets established annually
• Unknown natural disturbance, biodiversity and natural succession benchmarks	• targets established annually
• Unreliable resource inventories	• targets established annually
• Inadequate SFM support tools	• targets established annually
• Inadequate spatial resource maps	• targets established annually
• Incomplete fish and fish habitat management objectives	• targets established annually
• Fish/fish habitat model development	• targets established annually
• Lack of alternative harvesting experience	• targets established annually
• Lack of archaeological value and preservation objectives	• targets established annually
• Incomplete visual sensitivity objectives	• targets established annually
• Inadequate understanding of managed stand and site productivity potential	• targets established annually
Enhanced Environmental Values	
Watershed assessment and restoration: • Lower Mesilinka • Lower Osilinka • Misinchinka • Russell • Nation	• Complete restoration and effectiveness evaluation for five watersheds by 2003/04

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[11] Regional investment priorities are the key initiatives or projects that have been identified within the regional targets established for each of Forest Renewal BC's strategic objectives.

Strategic Objective	Output Target
Sustainable Harvest	
Backlog and enhanced silviculture activities: • tree improvement • seeds and seedling purchases • silviculture surveys • site preparation • backlog planting • brushing • spacing • pruning • fertilizing	• 575,000 cubic metres by 2003/04

Appendix 4 – Mackenzie Forest District Resource Management Plan Process

Mackenzie Forest District Resource Management Plan Process

Final Draft

August 16, 2001

The members of the Mackenzie TSA Senior Managers Group have agreed to the Mackenzie Forest District Resource Management Plan process as follows.

DAVE FRANCIS, MINISTRY OF FORESTS

JOHN METCALFE, MINISTRY OF WATER, LAND AND AIR PROTECTION

DAN ADAMSON, MINISTRY OF SUSTAINABLE RESOURCE MANAGEMENT

JOAN THOMAS, ABITIBI CONSOLIDATED COMPANY OF CANADA

JOHN MORELAND, SLOCAN FOREST PRODUCTS

Mackenzie Forest District
Resource Management Plan Process

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Background

1.1 Resource Management Planning

The purpose of the Resource Management Planning (RMP) process is to identify regionally significant resource investment priorities for the Omineca/Peace region that reflect:

- the strategic objectives and investment criteria of Forest Renewal BC
- the resource management stewardship responsibilities of the Ministries of Water, Land and Air Protection (MWLAP), Sustainable Resource Management (MSRM) and Forests (MoF)
- the technical expertise and advice of all forest licensee stakeholders, generally represented by the Northern Forest Products Association[12].

The structure for developing the RMP includes a number of committees at the regional and district level including:

- Senior Resource Managers Committee
- Omineca/Peace Steering Committee
- Regional Technical Planning Committees
- District Stakeholder Groups.

During the RMP process Forest District Stakeholder Groups identify management issues and priorities at the district level. These issues and priorities are then consolidated and sorted at the regional level according to Forest Renewal BC strategic objectives (i.e., Strengthening Sustainable Forest Management (SSFM), Enhancing Environmental Values (EEV) and Sustainable Harvest (SH). Regional priorities are then developed for each strategic objective, which are then further prioritized by management unit.

Once completed, Forest Renewal BC then uses the RMP as a basis for preparing its regional investment plan. The regional investment plan allocates funds to projects according to the priorities established in the RMP. Once the investment plan has been completed, licensee stakeholders are then required to prepare work plans which identify the activities that will be undertaken to achieve the projects in the investment plan.

1.2 Resource Management Planning in the Mackenzie Planning Unit

During the 2000/01 RMP process there was concern in the Mackenzie Forest District that the RMP and investment plan did not adequately reflect the priorities that had been developed by the District Stakeholder Group. Consequently there was a discrepancy between Licensee work plans and the Regional Investment Plan, particularly in the level of investment allocated to each of Forest Renewal BC's forest and environment strategic objectives (EEV, SH and SSFM). The solution to this would be to have licensee involvement in the allocation of funding among the strategic objectives.

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[12] Not all licensees are or may be represented by the NFPA.

As a result of the problems experienced with the RMP process in the Mackenzie Forest District, a new pilot process has been developed which incorporates local issues and priorities into a five-year strategic planning framework. The new process includes a set of guiding principles, a detailed process outlining the steps for completing a strategic resource management plan and a description of roles and responsibilities. The process will result in a stand alone strategic resource management plan for the Mackenzie Forest District to be incorporated in the regional resource management plan as described in Section 3.4 *Plan Approval*.

The objective of the pilot RMP planning process in the Mackenzie Planning Unit is to provide increased flexibility to assist the Planning Group in reaching agreement on investment priorities. The increased flexibility will apply to the timing and outputs of projects delivered within a five-year timeframe consistent with Forest Renewal BC's targets and priorities.

Principles

The following principles will guide the Mackenzie RMP process:

- The process will be clear, simple and easy to understand
- All stakeholders will participate on an equal basis
- Stakeholders will designate appropriate staff (who have full authority to make decisions) to participate in the process and attend RMP meetings.
- Participants will make every effort to attend RMP meetings and participate actively in the process and will come fully briefed and prepared with all necessary supporting information.
- The process will function in an efficient, timely and effective manner and will be supported with sufficient resources (staff, budget, and designated responsibility for managing the process) to support its mandate.
- Participants will represent all interests within their organization and be personally accountable to those interests.
- Minutes will be recorded for every meeting clearly indicating the responsibility and completion date for each action item; participants must achieve their commitments by the agreed date(s)
- Decisions will be developed by consensus
- All stakeholder interests will be represented in the strategic plan
- Projects and activities must be implementable
- All stakeholders will be accountable for the implementation of projects and activities
- The process will include annual reviews of strategic priorities
- The overall pilot planning process will be reviewed annually to determine if it is achieving its goals.

Process

The Mackenzie RMP process will include the following steps:

1. Review work done to date to identify TSA management objectives (LRMP, TSR, etc) and update where necessary
2. Identify regional output targets and RMP priorities that apply to the Mackenzie TSA
3. Develop Mackenzie Strategic Resource Management Plan
4. Approve Plan
5. Implement Plan
6. Conduct annual review of plan.

A diagram describing the key steps in the process is included as Attachment 1.

3.1 TSA Management Objectives

The Mackenzie Strategic Resource Management Plan (MSRMP) must be guided by the resource management objectives for the TSA that have been developed through other processes such as the Mackenzie Land and Resource Management Plan (LRMP), the Timber Supply Review (TSR) and other resource planning processes.

3.2 Regional Output Targets and RMP Priorities

The regional targets that apply to the MSRMP will need to be identified at the front end of the planning process. These could include employment targets, timber volume, numbers of watersheds for restoration, partnerships, First Nation participation, key SFM issues, etc. The Mackenzie TSA RMP Planning Group will establish annual and five-year funding targets based upon supporting Forest Renewal BC's forest and environment strategic objective output targets.

Regional investment priorities for each of the Forest Renewal BC strategic objectives (SH, EEV, SSFM) should be reviewed and those that apply to the Mackenzie TSA should be identified and used to guide the development of the MSRMP.[13]

3.3 Strategic Resource Management Plan

The MSRMP will include the following sections:

I. Introduction
II. Issues and Opportunities
III. TSA Objectives and Regional Output Targets and Relevant RMP Priorities
IV. Strategic Priorities and 5-year Activity Plans for
    - ▹ Sustainable Harvest
    - ▹ Enhancing Environmental Values
    - ▹ Strengthening Sustainable Forest Management
V. Annual Performance Measures

---

[13] Regional investment priorities are the key initiatives or projects that have been identified within the regional targets established for each of Forest Renewal BC's strategic objectives.

Introduction

The introduction will indicate the purpose and briefly describe the process used to complete the MSRMP.

Issues and Opportunities

This section will provide the context for the MSRMP by describing current resource management issues and opportunities in the Mackenzie TSA.

TSA Objectives and Regional RMP Priorities and Targets

This section will identify the TSA resource management objectives, regional RMP priorities and FRBC targets used to guide the development of strategic priorities and five-year activity plans.

Strategic Priorities and Five-year Activity Plans

Strategic priorities and five-year activity plans will be developed for each of the Forest Renewal BC strategic objective categories.[14] The strategic priorities should reflect the TSA objectives and regional RMP priorities and targets as they apply to each of the categories. The five-year activity plans should indicate the timing and flow of work for activities identified in each strategic objective category.

This section should also indicate the percentage allocation of RMP funding across the strategic objective categories.

A summary of the process for preparing strategic priorities and five-year activity plans for each of the strategic objective categories[15] is as follows.

Sustainable Harvest

- Review TSA objectives and regional RMP priorities and targets relating to sustainable harvest[16]
- Develop strategic priorities for sustainable harvest (e.g., complete x hectares of backlog reforestation over the next 5 years)
- Define activities required to complete each strategic priority (e.g., assessment, site preparation, planting, brushing/spacing, etc.)
- Determine annual level of effort for each activity over 5-year period needed to achieve strategic priority.
- Define annual performance targets for SH.

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[14] Strategic priorities may be identified for other forest management initiatives that do not meet the criteria of Forest Renewal BC's strategic objective categories. Other funding sources for these initiatives may need to be identified.

[15] Forest Renewal BC's strategic targets need to be completed by 2004 and may be revised after this date.

[16] The Ministry of Forests indicated that it has a legal obligation to undertake backlog reforestation. This obligation will need to be clarified in the context of the TSA objectives relative to the RMP.

Enhancing Environmental Values

- Review TSA objectives and regional RMP priorities and targets relating to enhancing environmental values
- Develop strategic priorities for environmental values (e.g., complete watershed restoration for 5 watersheds over the next 2 years, and incorporate new watersheds as appropriate.)
- Develop five-year work plan and annual activities for completion of restoration work on each watershed
- Define annual performance targets for EEV.

Strengthening Sustainable Forest Management

- Review TSA objectives and regional RMP priorities and targets relating to strengthening sustainable forest management
- Identify the SSFM issues that relate to the Mackenzie TSA
- Develop strategic priorities for each of the relevant SSFM issues (e.g., complete predictive ecosystem mapping within 5 years)
- Define activities required to complete each strategic priority (e.g., VRI state of inventory, VRI inventory, etc.)
- Develop five-year work plan and annual activities for completion of each strategic priority.
- Define annual performance targets for SSFM.

Annual Performance Measures

Based on the annual performance targets identified for each strategic objective category, establish measures for completing annual performance assessments. These measures should provide an indication of the progress achieved relative to established targets for each activity.

3.4 Plan Approval

Once completed, the Mackenzie Strategic Resource Management Plan will be forwarded to the Omineca/Peace RMP Steering Committee for review. The purpose of the review will be to ensure that the plan is consistent with FRBC investment criteria and regional output targets and relevant priorities provided in the regional RMP.

Any recommended changes to the plan will be discussed with the Mackenzie TSA RMP Planning Group and incorporated into the plan as appropriate. The plan will then be reviewed and approved by the Mackenzie TSA Senior Managers Group. Following approval by the Senior Managers Group, the plan will be forwarded to Forest Renewal BC to be incorporated into the regional investment plan. The Mackenzie RMP will be a stand-alone plan. Its strategic priorities and activity plans will be reflected in the regional investment plan and the complete MSRMP will be appended to the regional investment plan. The Mackenzie RMP will not be modified or changed to fit the regional format.

3.5 Implementation

Once the regional investment plan for the Omineca-Peace region has been approved[17] Forest Renewal BC will inform agreement holders and request that they develop work plans that are consistent with the investment plan and reflect the strategic priorities of the MSRMP.

Work plans for licensees in the Mackenzie District should be generally consistent with the activity plans developed in the MSRMP.

3.6 Annual Review

A review of the MSRMP will be conducted each year to determine whether Activity Plan annual performance targets have been met. In addition TSA objectives and regional targets and RMP priorities will be reviewed to see if there have been any changes.

If annual performance targets have not been met, or have been exceeded, Activity Plans in the MSRMP will need to be adjusted accordingly. Likewise, if TSA objectives or regional targets or priorities have changed or if new information is provided (e.g., results of a silvicultural analysis), strategic priorities and 5-year activity plans may need to be changed as well.[18]

A comprehensive performance review should also be conducted every five-years to determine whether the desired outcomes (i.e., strategic priorities) in the MSRMP have been achieved.

Roles and Responsibilities

A Mackenzie TSA Senior Management Group will be established to oversee the planning process and to approve the Mackenzie Strategic Resource Management Plan once it has been completed. The Senior Management Group will include the following representatives:

- Mackenzie Forest District (Dave Francis, District Manager)
- Ministry of Water, Land and Air Protection (John Metcalfe, Regional Manager Fish, Wildlife and Habitat)
- Ministry of Sustainable Resource Management (Dan Adamson, Acting Regional Manager Planning; position vacant)
- Abitibi Consolidated (Joan Thomas, Fibre Supply Manager)
- Slocan Forest Products (John Moreland, Woodlands Manager)

The role of the Senior Management Group will be to:

- approve the Mackenzie RMP planning process
- approve the completed MSRMP and subsequent annual revisions
- resolve disputes arising from the Mackenzie TSA RMP Planning Group.

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[17] Regional Investment Plans are approved by the Forest Renewal BC Board of Directors.

[18] Given the multi-year flow of funding and effort on projects, there may be specific periods (as significant phases of projects are being completed) when a review of funding priorities is most appropriate.

The Mackenzie TSA RMP Planning Group will be responsible for developing the Mackenzie Strategic Resource Management Plan. The Planning Group will include the following representatives:

- Mackenzie Forest District (Bruce Armstrong, Operations Manager; Zoran Boskovic, Planning Forester)
- Ministry of Water, Land and Air Protection (Leslie Yaremko[19], Forest Renewal Section Head)
- Ministry of Sustainable Resource Management (Leslie Yaremko, Forest Renewal Section Head)
- Abitibi Consolidated (Shirley Gilmour, Administration Superintendent; Micheline Snively, Assistant Administration Forester)
- Slocan Forest Products (Randy Hart, Manager of Forestry and Planning; Karlijn de Been, Acting FRBC Coordinator)
- Forest Renewal BC (Bill Jensen, Investment Officer; Christine Gelowitz, Investment Officer)
- Ministry of Forests, Prince George Regions (Les Herring, Incremental Practices Forester)[20].

The representatives from each participating organization will be required to have the authority to make decisions relating the MSRMP on behalf of their respective organizations. Other representatives from participating organizations may be invited to contribute to the process in cases where technical issues relating to the development of the MSRMP are being discussed.

Participants will strive to reflect the interests of all stakeholders in the development of the MSRMP. Decisions will be developed by consensus and will be informed by relevant policies and guidelines and technical and local information.

Participants in the process will be accountable to attend meetings on a regular basis and to participate in good faith. When responsibilities relating to the implementation of the MSRMP are identified, participants will be accountable for carrying out these responsibilities in accordance with the spirit and intent of the plan.

Participating government agencies will assume a lead role in administering the process and will provide funding as required for a facilitator to manage the process during the initial preparation of the Mackenzie Strategic Resource Management Plan.

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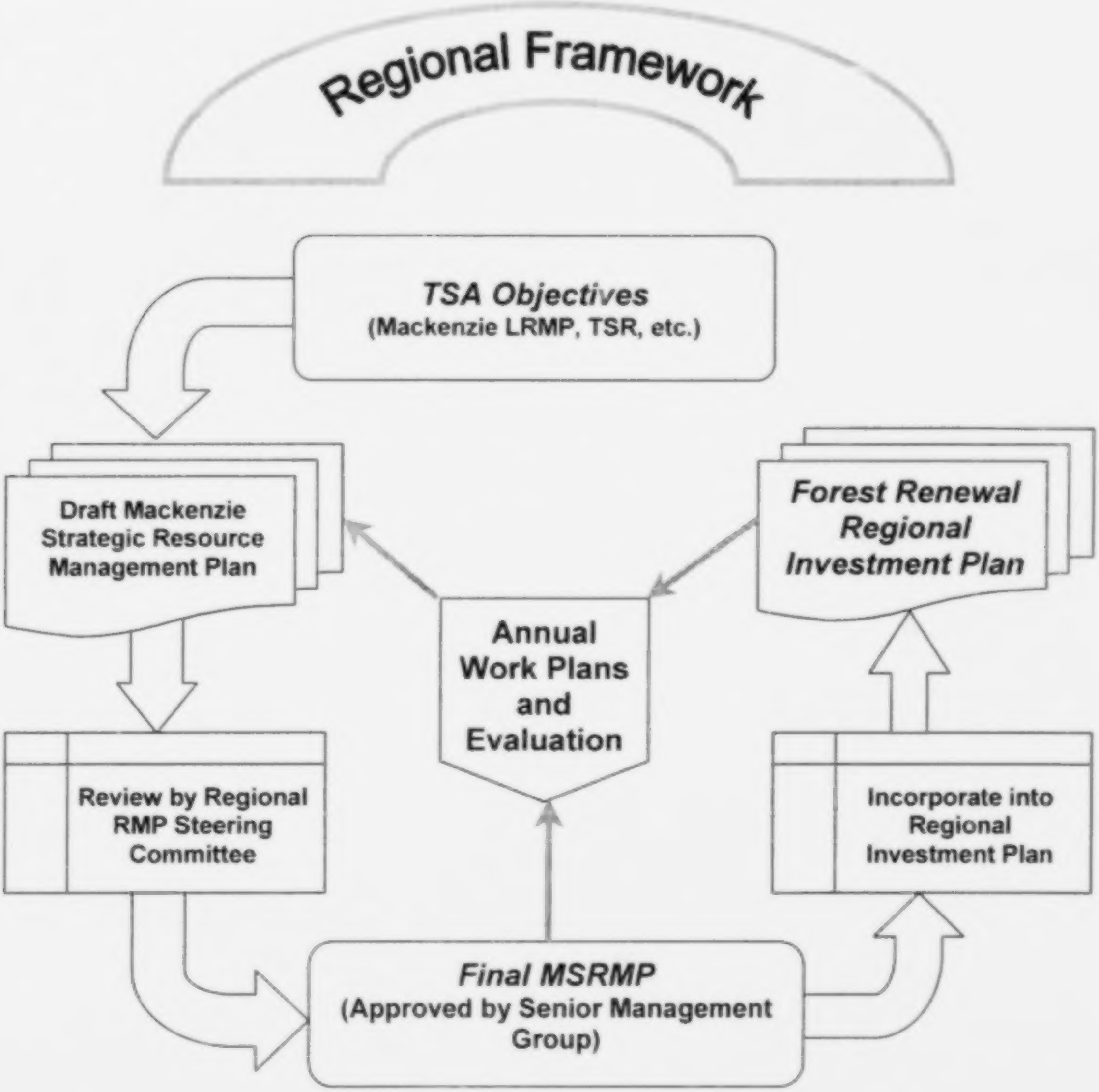
[19] Leslie Yaremko will be representing the Ministry of Water, Land and Air Protection and the Ministry of Sustainable Resource Management.

[20] ex officio member

Attachment 1

Mackenzie Forest District Resource Management Planning Process


Regional Framework
TSA Objectives
(Mackenzie LRMP, TSR, etc.)
Draft Mackenzie Strategic Resource Management Plan
Forest Renewal Regional Investment Plan
Annual Work Plans and Evaluation
Review by Regional RMP Steering Committee
Incorporate into Regional Investment Plan
Final MSRMP
(Approved by Senior Management Group)

SECTION 3

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SECTION 3

DETAILED ISSUE ANALYSES AND TACTICAL INVESTMENT RECOMMENDATIONS

Thirteen Tactical Planning Teams submitted their analysis of each knowledge gap issue, as well as detailed recommendations for specific corrective knowledge investments. This input was received in template format (Templates 1-3) with investment detail usually to the activity level. In order to compile all recommendations in a consistent format, and to facilitate the analysis of decision support tools (Section 2), the activity-level input for each issue was reviewed and grouped into three hierarchical categories:

- major, knowledge-building strategies making up the knowledge solution;
- complimentary tactics required to implement each strategy; and
- broad activities or specific projects comprising each tactic.

This Section contains the recommendations from each Tactical Planning Team, and is presented in a modified template format in order for the reader to easily identify the issue/strategy/tactic/ structure. Template headings distinguish the issue analysis; each strategy making up the recommended knowledge solution; each tactic comprising these strategies; and, where sufficient detail is available, specific activities and projects within each tactic. The original text and topics from the template submissions have been retained wherever possible.

ISSUE 1: UNRELIABLE FOREST RESOURCE INVENTORIES

Overview Description of the Regional Strategic Issue:

A complete and up-to-date inventory of all core forest resources is an essential prerequisite to Sustainable Forest Management planning. The achievement of Omineca-Peace SFM objectives within a forest management unit requires an accurate estimate of the physical attributes (size, composition; structure; location and dynamics) of each of the following core resources:

- forest vegetation and related stand features;
- ecological characteristics and interpretive units;
- recreation features; and
- forest soils/surficial geology characteristics and interpretive units.

The state of these core inventory data sets varies widely across the region; in many management units the data is incomplete, inaccurate or out-of-date. As a consequence they cannot be used reliably at either the strategic or operational level SFM planning. Resolution of this broad, regional SSFM issue requires implementation of four long-term investment strategies for completion and/or improvement of each core resource inventory. Due to the immense size of the Omineca-Peace land base, each inventory strategy must recognise the resource variability between each forest management unit (TSA, forest district and TFL), and the unique status of their inventories and planning pressures.

The following four, key regional knowledge building initiatives are recommended that will, if implemented fully, resolve this SSFM issue:

- Vegetation resource inventory;
- Ecosystem mapping;
- Recreation features inventory; and
- Terrain stability mapping strategy.

The success of each of these spatially explicit resource inventory initiatives depends, however, on the operational status of the region's topographic and contour inventory map base system. An underlying assumption of these recommendations, therefore, is that the Terrain Inventory Information Management (TRIIM2) is complete prior to implementation of the four forest resource inventory strategies.

Relationship to Sustainable Forest Management:

Reliable, spatially explicit resource inventories are essential to the success of sustainable forest management within each forest management unit of the Omineca-Peace region. Investment in core forest resource information may be the single most effective SSFM strategy since these data sets support most SFM planning processes, including land use, timber supply, habitat management, pest control, and biodiversity preservation.

Relationship to Strategic Resource Plans and Decisions:

LRMPs have been completed in all forest districts in the region. Achievement of the strategic goals specified in these plans depends on the knowledge and skills of local resource managers, and quality of the primary resource inventories at their disposal, and on which their management decisions are based. Uncertainty regarding the accuracy of these primary inventories may result in inappropriate management decisions and threaten the success of current land and resource use plans.

Cross Reference to Management Unit Issues (if applicable):

Implementation of each of the four component resource inventory strategies will benefit the following SFM initiatives within each forest management unit (TSA, forest district and TFL):

biodiversity preservation and OGMA management in Landscape Unit Planning;

Allowable Annual Cut (AAC) determination in the Timber Supply Review (TSR) process;

LRMP implementation;

forest development planning;

international forest certification;

wildlife habitat supply projection for threatened and non-threatened species; and

forest insect and disease management.

Status of Existing Knowledge:

Vegetation Resources Inventory

VRI was initiated in the province in 1996, and replaced earlier forest inventory methods with improved vegetation inventory classification and database design. The decision-support products of VRI are a spatial polygon map and database, and a ground plots database. The VRI system is broader in scope and is more reliable than past inventories because it uses detailed and statistically rigorous sampling procedures. VRI incorporates three related activities:

photo interpretation

ground-sample measurements

analysis and adjustment of initial estimates

VRI should be implemented within each management unit on an iterative schedule, which reflects periodic forest resource change due to development and natural disturbance. The recommended interval is normally five years, and is timed to coincide with timber supply analysis and AAC determinations.

The current status of VRI varies widely across the region.

Recreation Features Inventory

A recreation features inventory exists for the region. A review is required to determine whether it is complete and accurate. Comments from district staff and other local experts indicate that features are missing. Such features as caves and karsts are extremely difficult to inventory as their locations are hidden from view and require input from local experts.

Less populated areas with limited access are most likely where the recreation features inventory requires update and improvement.

Ecosystem Mapping

At present, predictive ecosystem mapping (PEM) is still in its infancy. It has been completed for some areas but there is a lack of knowledge on such things as the best TRIM based models to use to predict moisture regime and the utility of various data layers such as VRI or satellite image classification for predicting site series in different vegetation and terrain types throughout the region.

Terrain Stability Mapping

Terrain stability mapping has been conducted at various intensity levels for portions of all forest districts. Prior to FRBC, a small group of mappers was involved in terrain stability mapping. After FRBC began supporting terrain stability mapping, and advertised large contracts, many more firms became involved. Not all mapping conducted in those early years of FRBC funding would meet present-day standards. Some of the mapping was too conservative, i.e. areas that were relatively stable were sometimes classified as unstable, or too broad of areas with small percentages of unstable land were included in polygons that were largely stable. Such over classification has led to unnecessary terrain stability field assessments and also has timber supply implications.

Recommended Knowledge Solution Strategies:

Four regional resource inventory knowledge building strategies are recommended:

Vegetation Resources Inventory Strategy;

Recreation Features Inventory Strategy;

Ecosystem Mapping strategy; and

Terrain Stability Mapping Strategy.

Each strategy is described in detail the following sections

Define Performance Indicators, Targets & Milestones:

Performance indicators, targets and milestones are discussed subsequently for each strategies and tactics.

Describe Relationship to Other SSFM Knowledge Strategies (if applicable):

Relationships to other SSFM knowledge strategies are discussed for each strategy and tactic.

Strategy 1: Vegetation Resources Inventory

Overview Description of the Knowledge Strategy:

The Regional Vegetation Resources Inventory knowledge strategy integrates, in a single, comprehensive strategic plan, the recommended schedule and estimated costs for implementing Ministry of Sustainable Resource Management (MSRM) Vegetation Resources Inventories (VRI) in all management units in the Omineca-Peace region over a five year period. VRI is a recently improved inventory system for classifying, sampling and mapping the quantity and quality of timber, other vegetation and features resources, including shrubs, herbs, woody debris, and soil condition.

Vegetation Resources Inventories yield forest resource data and information to increase the SFM knowledge base in the region. These core resource data sets directly support a wide range of management decisions, or contribute indirectly in the development of specialised SFM decision-support tools. Vegetation Resource Inventories are intended to cover the entire land base of the region, including timber supply areas, tree farm licensees, parks and private land.

Status of Vegetation Resource Inventories:

VRI was initiated in the province in 1996, and replaced earlier forest inventory methods with improved vegetation inventory classification and database design. The decision-support products of VRI are a spatial polygon map and database, and a ground plots database. The VRI system is broader in scope and is more reliable than past inventories because it uses detailed and statistically rigorous sampling procedures. VRI incorporates three related activities:

- photo interpretation

- ground-sample measurements

analysis and adjustment of initial estimates

VRI should be implemented within each management unit on an iterative schedule that reflects periodic forest resource change due to development and natural disturbance. The recommended interval is normally five years, and is timed to coincide with timber supply analysis and AAC determinations.

The current status of VRI varies widely across the region. Inventory sampling to new, VRI standards has been implemented, or is currently underway four forest management units:

Dawson Creek Forest District

TFL 48, Canadian Forest Products Ltd., Chetwynd

TFL 30, Canadian Forest Products Ltd., Prince George

Supply Blocks E, F and G, Prince George TSA, Prince George Forest District

A VRI implementation plan is currently being designed for the following two management units:

Supply block D, Prince George TSA, Vanderhoof Forest District

Fort Nelson TSA, Fort Nelson Forest District

The remaining management units in the region have no VRI implementation plan in place:

Fort St. John TSA, Fort St. John Forest District

Mackenzie TSA, Mackenzie Forest District

Supply Blocks A, B and C, Prince George TSA, Fort St. James Forest District

Robson Valley TSA, Robson Valley Forest District

TFL 42, Tanizul Timber, Ltd., Fort St. James

TFL 53, Dunkley Lumber Ltd., Strathnaver

Of these six units, recent Inventory Audits in TFL 42, TFL 53, the Robson Valley TSA, and the Prince George TSA Supply Blocks A,B, and C (Ft. St. James Forest District) confirm that the accuracy of the existing forest cover inventory volume estimate is acceptable. Priority for re-inventory to VRI standards is therefore recommended for the Fort. St. John and Mackenzie TSA's.

Recommended Tactics in the Strategy:

The VRI knowledge strategy should be implemented employing three, sequential tactics:

VRI Implementation Planning

VRI is a complex and costly initiative, requiring a clearly defined strategy. and This Strategic Planning process is a prerequisite to conducting VRI activities. It is important to complete these districts so that prioritisation of the entire Forest Region can occur

VRI Phase 1 Photo Interpretation and Mapping

VRI Phase 2 Sampling

Describe Tasks, Deliverables, Targets and Milestones:

Described for each Tactic.

Tactic 1	VRI Implementation Planning

Tactical Summary:

VRI Implementation Plans (also known as "VRI Strategic Plans") are developed in partnership with stakeholders within a TSA, forest district, or TFL. Implementation planning consists of examining existing inventory information and seeking agreement between stakeholders regarding VRI requirements and priorities. Priorities are influenced by higher-level plans (TSR and LRMP).

VRI is a complex and costly initiative, requiring a clearly defined local strategy and implementation plan. This tactic is a prerequisite to conducting VRI activities.

Status:

Six of eight districts have VRI plans completed.

Fort St. James and Robson Valley require new implementation plans.

The initial plan for Dawson Creek is nearing completion, and should be revised.

A plan is also required for the Prince George District.

Two TFL's have VRI completed or nearing completion. (TFL 30 and 48).

TFL's 53 and 42 (Dunkley and Tanizul) have not indicated an interest to date in VRI.

Required Knowledge Building Activities of this Tactic:

The VRI Implementation Plan documents the agreement between Government and Licensee stakeholders regarding VRI requirements in the Management Unit. The VRI Plans has a 5-year time frame. Evaluation of LRMP and TSR documents is required, as the inventory is needed to support decision making. Assessment of existing timber inventory and timber audits helps guide plan development.

Strategic Performance Indicators, Targets & Milestones:

Completed Inventory Plan documents signed by all participating stakeholders. The Implementation Plan is an agreement between licensee, Ministry of Environment, and BCFS, for conducting the VRI.

Tactical Objectives:

To find agreement between MOF, MELP, and Licensees regarding the direction and priorities of VRI activities by individual Management Unit. The final product is a Strategic Plan agreed to by the stakeholders and an operational implementation plan, which provides for long term planning (5 years). The plan outlines roles and responsibilities of the stakeholders along with the expectations (goals). Provided progress is made annually the plan is an extremely valuable tool to manage an Inventory Program tailored for the Management Unit.

Describe Tasks, Deliverables, Targets and Milestones (Tactical):

1. Review available inventory information	Nov 2001
2. Review TSR, LRMP, data and info requirements	Nov 2001
3. Evaluate which VRI activities will provide solutions and benefits to the Higher Level Plans	Jan 2002
4. Convene Stakeholders meeting for discussion and input.	Feb 2002
5. Prepare VRI Strategic Draft Plan	Apr 2002
6. Seek agreement consensus sign-off from stakeholders	June 2002

7. Prepare Project Implementation Plan Aug 2002

Conduct Ft. St. James and Robson Valley Forest District Strategic VRI plans.

Complete Strategic Inventory Plan for Dawson Creek, March 2003

Complete Strategic Inventory Plan for Prince George, March 2004

Complete Strategic Inventory Plan for Fort Nelson, March 2006

Cost Sharing:

MOF, MELP, and Licensee staff time and travel costs will be contributed at no cost.

Consultant will be hired using FRBC funds to facilitate meeting and to prepare the Strategic VRI Plan. MOF staff and MYA holders will prepare the Project Implementation Plan.

Partnerships:

The Strategic VRI Plan forms an agreement between the stakeholders (MOF District, Licensees, MELP) on what VRI activities are to be conducted, their sequence, accompanied by estimates of costs.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		45 000	15 000		20 000		80 000	4

Tactic 2	VRI Phase 1- Photo Interpretation and Mapping

Tactical Summary:

This VRI tactic consists of the collection of new vegetation resource data and information through photo interpretation, ground calibration, and digital mapping. The new information will be collected to RIC standards and will form a vital data set of the corporate database.

VRI Phase 1 will provide vegetation Cover Maps and Database for the Ft. St. John, Mackenzie and Prince George Forest Districts.

Status:

VRI is the newly developed inventory system, which replaces conventional forest cover or timber inventory system. VRI Phase 1 standardised inventories have been conducted in Vanderhoof, Fort Nelson and Fort St. John, as well as in TFL 30 and TFL 48. The area mapped to VRI specifications comprises approximately 4.0 million hectares or about 15 percent of the total land area of the Prince George Forest Region. The remaining 85 percent contains forest cover inventory of various vintages, however most parts of the region have been re-inventoried within the past 10 years. A small portion predominately located in the north contains surveys, which date back thirty years, and is interpreted from forty-chain photography. These old inventories are found in Fort St. John, Fort Nelson and Mackenzie and are the highest priority for new inventory. Strategic Inventory Plans for these three districts have been developed to address VRI requirements involving stakeholders. Collection of information will be to provincial standards, and mapping will be registered to TRIM II. The Strategic Inventory Plan has considered available resources such as photography, silviculture data, and data collected from previous surveys.

The current status of VRI phase 1 is as follows:

Prince George Forest District - new

Mackenzie forest District – new

Ft. St. John Forest District – on going

Required Knowledge Building Activities in this Tactic

The Phase 1 activity consists of photo acquisition, image scanning, photo interpretation, and digital mapping, as well as field calibration measurements and observations to aid photo interpretation

Where inventories are older than 20 years, the inventory should be completely redone. In areas with surveys conducted within the past ten years, the accuracy of the stratification or delineation of the polygons should be examined to determine whether the delineated polygon boundary integrity still exists. Where polygon boundary can be retained classification retrofit can be a cost effective alternative. VRI phase 1 provides baseline vegetation along with some ecological information both spatial (map) and attribute (text). This data is meant to provide land and resource managers information for decision making. The VRI Phase 1 product (map and attribute) will benefit planners and resource managers aimed at implementing and achieving the goals set in LRMP

Strategic Performance Indicators, Targets and Milestones:

Completion of 70% of the THLB in Fort Nelson in 2002

Completion of 100% of the THLB in Fort St. John over 4 years

Completion of 100% of the THLB in Mackenzie over 5 years

Relationship to SSFM Knowledge Strategies:

VRI Phase 1 is linked to SSFM Issue;

Issue#3 – Species at Risk

Issue#4 – Wildlife Habitat

Issue#5 – Natural Disturbance Type

Issue#6 – Support Decision Support Tools

Issue#9 – Support Pest Management Decision Tools

Cross Reference to Management Unit Activities (when complete):

New Photography in Mackenzie 1:30,000 colour	-2002
1,000,000 hectares – Fort St. John	-2002
1,000,000 hectares – Fort St. John	-2003
5,000,000 hectares – Mackenzie	-2006
1,500,000 hectares – Prince George	-2006

Tactical Objectives:

The objective is to replace outdated inventories for the next TSR. These maps and accompanying database will provide information to support operational planning. In particular Ft. St. John will benefit from new mapping. New mapping will also benefit all three Districts in the implementation for the respective LRMPs.

Describe Tasks, Deliverables, Targets and Milestones (Tactical):

Milestone/Task	Target Date
1. Acquire photography in Mackenzie	Sept 30,2002
2. Scan Imagery in Ft. St. John	June 30,2002
Photo Acquisition and Scanning – Prince George	March 2004
3. Photo Interpretation, Field work, Mapping – Ft. St. John approximately 2 million hectares	March 2005
4. Photo interpretation, Field work, Mapping – Mackenzie approximately 5 million hectares	March 2007
5. Photo Interpretation, Field work, Mapping – Prince George approximately 1.5 million hectares	March 2007

Cost Sharing:

New VRI Photo interpretation is cost shared with the Ministry of Forests. A 60% (MOF) to 40% (FRBC) cost splitting formula is applied. In the Omineca-Peace Region a flexible funding agreement between MOF and FRBC is being used to manage funding requirements over the duration of the activity rather than at the beginning of each fiscal year.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
800 000	2	1 972 000	4 167 000	2 705 000	750 000	750 000	9 884 000	5

Tactic 3	VRI Phase 2- Field Sampling

Tactical Summary:

This knowledge strategy is to collect new measurements through field sampling. New data in the form of measurements will be gathered to RIC standards, which follow a rigorous statistically valid sampling process to prevent introduction of bias. The purposes of field sampling are to: quantify the resource attribute accompanied by a statement of accuracy and to localise attribute values such as stand volumes, growth, site productivity estimates according to the Forest Management Unit to which the samples apply.

Status:

Statistically valid sampling has not been conducted in this province to quantify resource values. VRI Phase 2 field sampling involves developing a comprehensive Sampling Plan; selection of polygons for sampling and plot locations, from within a population which in this case is a Forest Management Unit (TFL or Forest District). Collectively these samples represent the entire population of the Forest Management Unit.

Measurements are taken at predetermined map locations and located precisely in the field. A relatively small number of samples (150-250) is required to quantify broad resource values to the +/- 10% accuracy level 19 times out of 20. The number of samples is influenced by the variations of species, stand structure types, species and size mixtures rather than by area or size of the Management Unit.

A subset of these samples can be used for other purposes such as for decay and taper measurements through NVAF sampling while others may be chosen for Monitoring Plots for periodic remeasurements to determine trends in stand dynamics, effects of land use, and effects due to environmental changes.

Four Forest Management Units have been VRI sampled or currently being conducted:

Dawson Creek Forest District

Canfor's TFL 48 Chetwynd

Canfor's TFL 30 McGregor Model Forest

Prince George Forest District

Sample Plans are being designed for Vanderhoof and Ft. Nelson Forest Districts. The remaining 4 Forest Districts and 2 TFL's do not have sampling plans prepared. However, Field Inventory Audits in TFL 42, 53, Robson Valley and Ft. St. James Forest District confirm that the inventory is accurate for volume.

The two Forest districts that most warrant sampling, are Ft. St. John and Mackenzie.

Phase 2 Sampling will resolve attribute and volume discrepancies in spruce leading stands, provided piece distribution and taper information for "problem types" such as small pine and balsam. NVAF Sampling will resolve decay estimates in aspen and pine as well as provide taper information for pine and balsam. WPV (within polygon variation) sampling will provide estimates on polygon attribute accuracy on a polygon basis.

Required Knowledge Building Activities in this Tactic

The VRI Phase 2 tactic is comprised of the following steps:

Sample Plan Preparation

Determine sample size and select polygons to meet accuracy requirements

Identify location of plots on maps, and photos

Determine most cost effective access mode to samples

Ensure that sampling will provide solutions and answers for TSR, LRMP, and other management issues

Data Collection

Hire eligible consultants (provincial certification list)

Conduct quality assurance

Data Compilation, analysis and Syntheses

Conduct data queries, examine trends and correlations

Data interpretations

Carry out summation, prepare report, disseminate results

Data storage

Adjust Phase 1 attributes (database), adjust Growth Models

Tactical Implementation is based on the following considerations:

Conduct sampling according to Forest District and TFL

Conduct basic Phase 2 sampling (TEP and Full VRI)

Conduct NVAF and WPV sampling to follow Basic Sampling

Avoid using Phase 2 plots for monitoring if the purpose of Monitoring is to determine sustainability and for certification purposes

Strategic Performance Indicators, Targets and Milestones:

Milestone	Date
Basic Phase 2 Sample collection & Monitoring Plots	2 years from date of commencement
NVAF Sampling	Third Year
WPV Sampling (optional)	Fourth Year

Relationship to SSFM Knowledge Strategies:

Phase 2 Sampling will quantify some very important ecological attributes or values such as CWD, wildlife trees, forage that are integral to wildlife management.

Tree data will provide information that benefits site productivity, and pest management objectives.

The sample data can also be used to benchmark or calibrate Decision Support Systems and Tools.

Cross Reference to Management Unit Activities (when complete):

All Management Unit with the exception of the 4 completed require sampling to quantify resource values. The most notable are:

Ft. Nelson

Ft. St. John

Mackenzie

Tactical Objectives:

The objective is to "localise" volumes, stand attributes and other values to account for local ecological conditions, which can influence resource values at a management unit level. Sampling will quantify with statistical accuracy various resource attribute values, which can be used for TSR, LRMP and to determine the amount of resource values which exist for certification purposes.

NVAF sampling will measure the amount of decay and taper associated with operational timber harvesting in deciduous stands, smaller size lodgepole pine, and in operating in a younger age profile. Such information is valuable to a forest industry facing obstacles in harvesting in old growth stands.

Within polygon sampling (WPV) will measure variability within delineated polygons to answer the question of how precise is the inventory at a polygon level.

Tasks, Deliverables, Targets and Milestones (Tactical):

Prepare Sample Plan		
	Fort Nelson Forest District	April 2002
Locate Samples on Maps & Photos		
	Fort Nelson Forest District	May 2002
	Vanderhoof Forest District (IFPA)	May 2002
Solicit RFP/Contract Award		June 2002
Field Data Collection – Fort Nelson		Oct 2003
	- Mackenzie, Fort St John	Oct 2005
Data Compilation & Analysis		Feb 2004
Data Interpretation		Mar 2005

NVAF Sampling		
	Vanderhoof	Oct 2003
	Prince George	Oct 2004
	Mackenzie	Oct 2006
WPV Sampling		
	Dawson Creek	Oct 2002
	Vanderhoof	Oct 2004
	Mackenzie	Oct 2006

Cost Sharing:

The MOF will provide staff to:

prepare the Sample Plan; select contractor; quality assurance; and data analysis. MOF staff in-kind contribution of $100,000. per annum.

Partnerships:

Final reports and summaries will be made accessible. The information, data, and measurements will contribute to the provincial database and stored at the Resources Inventory Branch (MOF). Individual sample data will be made available upon request.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		1 784 000	715 000	250 000	942 000	432 500	4 123 500	5

Strategy 2: Recreation features inventory

Overview Description of the Knowledge Strategy:

The Issue 1 Tactical Planning committee recommend that a review be conducted of the state, condition and accuracy of recreation features inventories within the P.G. forest Region. This is a knowledge gap identification process to determine which areas of the region have substandard recreation features inventory. In order to demonstrate that the resource is being managed for multiple resource values and that good land stewardship is practised, all locations of significant and important recreation features should be mapped. These important features include, thermal springs, white water classes, canoe routes, waterfalls, caves, karsts, unusual or rare rock or mineral deposits and historical sites. These are all physical features which once mapped would not change

Status of Existing Knowledge:

A recreation features inventory exists for the region. A review is required to determine whether it is complete and accurate. Comments from district staff and other local experts indicate that features are missing. Such features as caves and karsts are extremely difficult to inventory as their locations are hidden from view, and locating them requires input from local experts.

Less populated areas with limited access are most likely where the recreation features inventory requires update and improvement.

Required Knowledge Building Activities in this Strategy:

Review of the existing Recreation Feature Inventory.

Consultation with District and Region Staff and local experts from outdoor recreation clubs and guide outfitters to determine accuracy and completeness of existing inventory.

Identification of areas where knowledge gaps exist and where improvement is required. Evaluation of available mapping technology and local support resources.

Assign priorities for improved inventories, considering wilderness areas adjacent to recently created Parks and Protected Areas arising from LRMPs.

Registration of all Recreation Feature locations to TRIM base maps, adopting RIC standards.

Strategic Performance Indicators, Targets and Milestones:

Inventory improvements completion targets:

Ft. Nelson (adjacent to Muskwa-Kechika area)	May 2002
Mackenzie (Kechika-Gataga area)	May 2002
Ft. St. John (adjacent to Muskwa-Kechika area)	May 2002
Ft. St. James (Takla-Sustut area)	May 2002

Relationship to Other SSFM Knowledge Strategies:

Presence of Rec. Features is extremely useful for Visual Landscape Planning.

Archaeological Features and Sites are related to Recreation Features but due to their very sensitive management concerning archaeological features are planned separately. However often natural Recreation features also are of archaeological significance.

Karsts are also significant geological formations, which are linked to terrain mapping.

Tactic 1	Recreation Features Database Improvement

Tactical Summary:

Conduct a recreation features inventory review in high priority areas, recommend a means to improve any inadequacies, and initiate inventory update procedures.

Tactical Status:

Update process. (new)

Tasks, Deliverables, Targets and Milestones:

Hire Contractor in Recreation Inventory	June 2002
Conduct Review, consult local experts	Sept. 2002
Prepare Rec. Inventory Survey Plan	Dec. 2002
Implement Survey (complete by)	Sept. 2003
Complete New Revised Inventory Database	March 2004

Objectives:

To identify knowledge gaps in recreation features followed by improvement and updating of the inventory.

Cost Sharing:

MOF local staff time will be contributed.

Partnerships:

TFL's; BC Parks; First Nation; Communities; Tourism BC

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	250 000	150 000			450 000	3

Strategy 3: Ecosystem mapping

Overview Description of the Knowledge Strategy:

Developing and testing models to predict and map ecosystem units (site series) using existing information (TRIM models, forest cover, VRI, satellite image classification) plus collection of new data for model validation and accuracy assessment.

Status of Existing Knowledge:

At present, predictive ecosystem mapping (PEM) is still in its infancy. PEM has been completed for some areas but there is a lack of knowledge on such things as:

which TRIM based models to use to predict moisture regime; and

relative utility of various data layers such as VRI or satellite image classification for predicting site series in different vegetation and terrain types throughout the region.

Required Knowledge Building Tactics in this Strategy:

Organisation:

A regional PEM committee will be established to co-ordinate implementation of the strategy. The committee will determine where pilots should be completed, agree on mapping standards for different applications, refine accuracy assessment requirements, and co-ordinate PEM application workshops.

Synthesis, Analysis:

An assessment of TEM and PEM projects completed in the region will be completed to determine strengths and weaknesses of the completed projects.

An assessment of various models based on TRIM for predicting slope position and or moisture regime will be conducted

A number of test areas that represent different types of vegetation and terrain (e.g., boreal plateau wetland, wet montane) and where a variety of input sources are available and some TEM of PEM has been completed will be chosen. Different input sources will be combined in various ways into PEM models and tested against an independent sample to determine the accuracy level that can be obtained with the different input sources.

Once the best methods have been determined for the different areas a strategy to complete the areas requiring PEM will be conducted.

Resource Inventory:

PEM will be conducted in areas throughout the region following the strategy developed.

Extension:

A workshop to bring together the PEM developers and practitioners will be conducted to ensure the most effective use of this inventory.

Strategic Performance Indicators, Targets and Milestones:

Completion of Predictive Ecosystem Mapping over priority areas in the region within a period of 5 years.

Relationship to Other SSFM Knowledge Strategies:

Other strategies such as Managed Stand Productivity Potential (SSFM Issue#14) require PEM in order to be completed. Ecosystem mapping is proposed as the basis for improved site index estimates rather than using timber attribute information.

Tactic 1	PEM Model Research and Development

Tactical Summary:

The status, accuracy, utility and user-satisfaction of completed PEM and TEM projects will be completed for the region. Simultaneously, a research evaluation of will be conducted to determine the precision and utility of PEM models.

Status:

New

Tactical Objectives:

To document the strengths and weaknesses of completed ecosystem-mapping projects in order to assist with improvement of PEM methodology.

Tasks, Deliverables, Targets and Milestones (Tactical):

Three projects are recommended to implement this tactic.

Technical Evaluation of Regional TEM/PEM Mapping Projects:

- Information assembly;
- Client use surveys;
- Map-to-field accuracy evaluation;
- Evaluation reporting and recommendations.

PEM Model Evaluation:

- Information assembly;
- Test area selection;
- Local refinement of each PEM model;
- Accuracy evaluation using common data set;
- Comparison of results with conventional methods.

PEM Model Data Input Evaluation:

- Selection of test areas;
- Assembly of data input layers for evaluation;
- Localisation and refinement of PEM models to be tested;
- Comparison of prediction s with actual ecosystem units.

All three projects should be undertaken during the first year of the five-year strategic plan.

Project 1	Technical Evaluation of TEM/PEM Projects

Project Summary:

Assessment of completed PEM and TEM projects will be completed for the region. Tasks include assembly of information, survey of users, evaluation of accuracy assessments, and reporting.

Project Status:

New

Project Objectives:

To document the strengths and weaknesses of completed ecosystem-mapping projects in order to assist with improvement of PEM methodology.

Project Tasks, Deliverables, Targets and Milestones:

Information assembly;

Client use surveys;

Map-to-field accuracy evaluation;

Evaluation reporting and recommendations; and

Report documenting strengths and weaknesses of completed ecosystem mapping projects to be completed by October 2002.

Cost Sharing:

In kind contribution by MoF regional ecologist to assist with completion of report.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		10 000					10 000	1

Project 2	PEM Model Evaluation

Project Summary:

Assessment of TRIM based models for predicting slope position and/or moisture regime will be completed in co-operation with MoF Research Branch. Tasks include assembly of information for several test areas, refinement and running of modes, and evaluation of accuracy using common set of field data, and comparison to other methods such as the use of terrain maps, bio-terrain, and VRI.

Project Status:

New

Project Objectives:

To document the strengths and weaknesses of different TRIM based methods for predicting slope position and/or moisture regime.

Project Tasks, Deliverables, Targets and Milestones:

Information assembly;

Test area selection;

Local refinement of each PEM model;

Accuracy evaluation using common data set;

Comparison of results with conventional methods; and

Report documenting strengths and weaknesses of TRIM based methods for predicting slope position and/or moisture regime to be completed by December 2002.

Cost Sharing:

In kind contribution by MoF regional ecologist to assist with completion of report.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000					100 000	1

Project 3	PEM Model Data Input Evaluation

Project Summary:

Assessment of accuracy of PEM maps derived using different combinations of input layers (e.g., forest cover, classified, satellite image) for different areas of the region. Tasks include selection of areas, assembly of input layers, refinement and running of modes, evaluation of accuracy using common set of field data, and reporting of results.

Project Status:

New

Project Objectives:

To document the accuracy of PEM maps derived using different combinations of input layers for portions of the region with distinctly differing vegetation and terrain.

Project Tasks, Deliverables, Targets and Milestones:

Selection of test areas;

Assembly of data input layers for evaluation;

Localisation and refinement of PEM models to be tested;

Comparison of prediction s with actual ecosystem units; and

Report documenting accuracy of PEM maps derived using different combinations of input layers to be completed by March 2003.

Cost Sharing:

In kind contribution by MoF regional ecologist to assist with completion of report.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		500 000					500 000	1

Tactic 2	Regional Ecosystem Mapping
Tactical Summary: Completion of ecosystem mapping throughout the Omineca-Peace Region should be undertaken upon completion of Tactic 1.	
Status: New	
Tactical Objectives: To fully implement Predictive Ecosystem Mapping in priority areas in the region within 5 years.	
Tasks, Deliverables, Targets and Milestones (Tactical): Two projects are recommended to implement this tactic: Preparation of a regional Tactical Implementation Plan; and Operational implementation of the plan in region. Completion of both projects should be by March 31, 2007.	

Project 1	Regional Ecosystem Mapping Tactical Planning

Project Summary:

Develop a tactical plan to complete PEM in priority areas of the region over a five year time period. Tasks will include assessment of status of areas completed to date, development of priority rating scheme, and development of the tactical implementation plan.

Project Status.

New

Project Objectives:

To develop a medium-term tactical plan for completion of PEM for priority areas of the region.

Project Tasks, Deliverables, Targets and Milestones:

Preparation of status report identifying all currently mapped areas.

Construction of a regional PEM priority ranking scheme.

Development of a regional implementation schedule and refined operational budget estimate.

Design or re-design of mapping standards incorporating evaluation results and recommendations from previously completed research and development activities.

Cost Sharing:

In kind contribution by MoF regional ecologist to assist with completion of report.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		5 000					5 000	1

Project 2	Regional Ecosystem Mapping Implementation

Project Summary:

Completion of PEM over priority areas within the region within a 5-year time period

Project Status:

New

Project Objectives:

To complete PEM for priority areas of the region.

Project Tasks, Deliverables, Targets and Milestones:

To be determined by PEM Tactical Implementation Planning

Cost Sharing:

In kind contribution by MoF regional ecologist to assist with completion of report.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			500 000	500 000	500 000	500 000	100 000	4

Tactic 3	Regional PEM Extension

Tactical Summary:

Presentation of a workshop on "Putting PEM to work". Tasks include workshop development and organisation.

Status:

New

Project Objectives:

To develop and conduct a workshop that brings PEM developers, practitioners and future users together to demonstrate current uses, showcase potential uses, and generate ideas for future uses of PEM.

Tasks, Deliverables, Targets and Milestones:

This project should be undertaken in year 2 of the 5-year strategic plan.

Workshop and other extension details to be determined.

Cost Sharing:

In kind contribution by MoF regional ecologist to assist with completion of report.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			50 000				50 000	1

Strategy 4: Terrain Stability Inventory

Overview Description of the Knowledge Strategy:

Conduct a research and development initiative aimed at:

Evaluating the past and current status of terrain hazard classification and mapping;

Developing a risk analysis decision support tool for assigning priority for TSM; and

Implementing a pilot test of the application of the risk-ranking scheme in two forest districts.

Status of Existing Knowledge:

Terrain stability mapping has been conducted at various intensity levels for portions of all forest districts. Prior to FRBC, a small group of mapping specialists was involved in terrain stability mapping. After FRBC began supporting terrain stability mapping, and advertised large contracts, many more firms became involved.

\Not all mapping conducted in those early years of FRBC funding would meet present-day standards. Some of the mapping was too conservative, i.e. areas that were relatively stable were sometimes classified as unstable, or too broad of areas with small percentages of unstable land were included in polygons that were largely stable. Such over classification has led to unnecessary terrain stability field assessments and also has timber supply implications.

Required Knowledge Building Tactics in this Strategy:

The regional Terrain Stability Mapping Strategic Plan consists of a single, short-term tactic, implemented via three, phased research and development projects. This tactic will improve the efficiency and reliability of future use of TSM technology.

The three recommended knowledge projects are:

Review existing terrain stability mapping in all forest districts of the Omineca-Peace Region during year one of the Terrain Stability Mapping Strategic Plan;

A pilot terrain stability risk analysis in two forest districts in year two of the Terrain Stability Mapping Strategic Plan and preparation of a resultant priority mapping plan and methodology;

Implementation of terrain stability classification and mapping based on the priority-mapping plan.

Implementation of these tactics will necessitate a diap viewer with loaded air photos installed and operational.

Strategic Performance Indicators, Targets and Milestones:

Initiate TSM review	May 2003
Conduct Risk analysis in Fort St. John and Fort Nelson forest districts	Sept 2004
Implement priority mapping plan in Fort St. John and Fort Nelson districts	May, 2005

Relationship to Other SSFM Knowledge Strategies:

Karst features are also significant geological formations, which are linked to terrain mapping. Terrain attributes (soil moisture, soil nutrient and soil texture) have significant implications and value for PEM. Terrain data on stability and productivity will provide critical information for Sustainable Harvest and Alternative Harvesting practices.

Tactic 1	Terrain Stability Mapping Research and Development

Tactical Summary:

This tactic consists of a review of the state, accuracy and utility of terrain mapping, followed by a pilot study aimed at developing a risk-ranking scheme for assessing the need for detailed mapping.

Status of Knowledge:

Tactical Objectives:

To improve the accuracy and efficiency of terrain hazard assessment and mapping.

Project Tasks, Deliverables, Targets and Milestones (Tactical):

Completion of all three research and development projects by March 31, 2005

Project 1	Regional Terrain Stability Mapping Tactical Planning

Project Summary:

Conduct a review of the state, condition and accuracy of terrain stability mapping within the P.G. forest Region. Inventory gaps exist in every district and some early mapping may be substandard. Not all areas, however, require detailed mapping. A risk assessment should be undertaken to prioritise areas that require mapping for both strategic and developmental purposes.

Project Status:

New

Project Objectives:

Review state of terrain stability mapping in the Omineca-Peace Region.

Project Tasks, Deliverables, Targets and Milestones:

Prepare a report and recommendations on the quality and reliability of TSM by March 31, 2004.

Cost Sharing:

In kind contribution by MoF regional ecologist to assist with completion of report.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000					100 000	1

Project 2	Pilot Study of Terrain Stability Mapping Risk Analysis

Project Summary:

Perform TSM risk analysis in the Fort St. John and Fort Nelson forest districts to identify high priority areas that require further terrain stability mapping.

Project Status:

New

Project Objectives:

Perform risk analysis for areas to prioritise areas that require further mapping.

Project Tasks, Deliverables, Targets and Milestones:

Develop a mapping strategy for the Northeast by March 31 2004.

Cost Sharing:

In kind contribution by MoF regional ecologist to assist with completion of report.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			200 000				200 000	1

Project 3	Pilot Study of High Priority Terrain Stability Mapping

Project Summary:

Implement terrain stability mapping pilot project for priority terrain in Fort St. John and Fort Nelson.

Project Status:

New

Project Objectives:

Complete high priority TSM in two forest districts.

Project Tasks, Deliverables, Targets and Milestones:

Initiate TSM high priority pilot project in May, 2004

Cost Sharing:

In kind contribution by MoF regional ecologist to assist with completion of report.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
				300 000			300 000	1

VEGETATION RESOURCES STRATEGIES GLOSSARY

Attributes: polygon based estimates described by photo interpreters.

Basal area: the cross-sectional area (in square meters per hectare) of all living trees visible to the photo interpreter in the dominant, co dominant and high intermediate crown positions in each tree layer in the polygon.

Basal area per hectare: the area of the cross-section of tree stems near their base, generally at breast height and including bark, measured over1 ha of land (FPCode). For purposes of this inventory, the cross-sectional area (in square meters) of all living trees 4.0 cm DBH or greater, expressed as a per hectare value for the entire polygon.

Call-grading: the process used to assign one of the Vegetation Resources Inventory grades (modified coastal log grades) to standing and fallen trees.

Canopy: the forest cover of branches and foliage formed by tree crowns. (FPCode).

Crown Closure: the percentage of ground area covered by the vertically projected crowns of shrubs or trees.

CWD – coarse woody debris: sound and rotting logs and uprooted stumps that provide habitat for plants, animals, and insects, and a source of nutrients for soil development. (FPCode). For purposes of this inventory – dead, woody material in various stages of decomposition located above the soil; pieces larger than 7.5 cm in diameter (or equivalent cross-section), and not self-supporting (such as trees or stumps).

Density: the average number of living trees in the polygon visible to the photo interpreter in the dominant, co dominant and high intermediate crown positions in each tree layer in the polygon. It is expressed as a per hectare value.

Estimated site index: an estimate of site productivity for tree growth indicated as the height, in meters, at breast height age 50 years.

Free – Growing: young trees that are as high or higher than competing brush vegetation with one meter of free-growing space surrounding their leaders. As defined by legislation, a free growing crop means a crop of trees, the growth of which is not impended by competition from plants, shrubs, or other trees. Silviculture regulations further define the exact parameters that a crop of trees must meet, such as species, density and size, to be considered free growing.

GIS – Geographic information system: a computer system designed to allow users to collect, manage and analyse large volumes of spatially referenced information and associated attribute data.

Grading: classifying timber, lumber or logs according to quality or end-use.

Land Base: the first level of the B.C. Land Cover Classification Scheme. This classifies the polygon as Vegetated, Non-Vegetated or unreported. The presence or absence of vegetation is recognised by the vertical projection of vegetation upon the land base within the polygon.

Land Cover Classification Scheme: refers to the B.C. Land Cover Classification Scheme, which forms Section 1 of this procedure document. It is derived from the original Vegetation Resources Inventory document *BC Land Cover Classification Scheme*, March 1999.

Land Cover Component: identifies a type of land cover, under the BC Land Cover Classification Scheme, to the most detailed level possible. They consist of continuous areas within the polygon that are individually 10% or more of the polygon area, and would otherwise be delineated and classified at approximately twice the map scale.

Land Cover Type: the second level of the BC Land Cover Classification Scheme. This classifies the polygon as Treed or Non-Treed; Land or Water.

Merchantable Volume: the amount of sound wood in a single tree or stand that is suitable for marketing under given economic conditions.

Minimum Polygon Size: to be set by contract supervisor as local user needs are identified. Suggested minimum sizes are 2 hectares for areas with distinct boundaries and 5 hectares for area with indistinct boundaries.

Net Factoring: a process used to estimate the net volume of sound wood (gross volume less decay) of an assigned log length.

NVAF- Net Volume Adjustment Factor: is a component of the VRI process. It is used to statistically adjust the VRI ground sampling net volume from ground samples (measurements) and will account for the possible tape equation error, net factor error, hidden decay in trees with no loss indicators or visible decay and hidden loss factor. NVAF requires destructive tree sampling in order to measure the amount of sound wood volume through deduction of decay and influence of taper.

Old Growth: old growth is a forest that contains live and dead trees of various sizes, species, composition, and age class structure. Old-growth forests, as a part of a slowly changing but dynamic ecosystem, include climax forests but not sub-climax or mid-serial forests. The age and structure of old growth varies significantly by forest type and from one biogeoclimatic zone to another.

PEM – Predictive Ecosystem Mapping: is a computer, GIS and knowledge based method to assist in the stratification of landscape into ecologically map units, typically site series. This is based on overlaying polygon themes and the processing of resultant polygons and attributes through computer analysis in association with a formalised knowledge base comprising ecological – landscape relationships.

Phase I: refers to the Provincial Vegetation Resources Inventory process involving photo estimation of detailed land cover attributes. Also referred to as Photo Interpretation.

Phase II: refers to the Provincial Vegetation Resources Inventory process involving ground sampling of polygon attributes. Data gathered is used to adjust Phase I estimates. Also referred to as ground sampling.

Polygon: a portion of land area delineated on mid-scale aerial photography of "like" or uniform land cover appropriate for applying land cover descriptions.

Polygon Delineation: the process of dividing the landscape into uniform polygons according to defined criteria.

Polygon Number: a unique number assigned to each polygon after it has been delineated.

Seral Stage: any stage of development of an ecosystem from a disturbed, unvegetated state to a climax plant community. (FPCode).

Site Index: an expression of the forest site quality of a stand, at a specified age, based either on the site height, or on the top height, which is a more objective measure.

Site Productivity: the inherent capabilities of a site to produce of provide the commodities or values for which the area will be managed in accordance with Section 4 of the Ministry of Forests Act, that is, timber, forage, recreation, fisheries, wildlife, and water. (FPCode).

Slope: the average gradient of the polygon expressed as a percentage.

SMR – Soil Moisture Regime: the average amount of soil water annually available for evapo-transpiration by vascular plants, averaged over several years.

SNR – Soil Nutrient Regime: the amount of essential nutrients, particularly nitrogen, available to vascular plants over a period of several years.

Soil Pit: an excavation into the mineral soil of sufficient depth to allow assessment of variability in soil physical properties within a defined area of land.

Species Composition: identifies the tree species in the polygon and provides an estimate of the percentage of each species present.

Stand: a community of trees sufficiently uniform in species composition, age, arrangement, and condition to be distinguishable as a group from the forest or other growth on the adjoining area, and thus forming a silviculture or management entity. (FPCode).

Succession: the gradual supplanting of one community of plants by another, the sequence of communities being termed a sere and each stage seral. (FPCode).

Surface Expression: describes the form and patterns of form and the surficial material within the polygon. It is described by letter codes that indicate the following forms: cone, depression, fan, hummock, rolling, plain, ridge, terrace, undulating, or none of the above.

TEM – Terrestrial Ecosystem Mapping: is the stratification of a landscape into map units according to a combination of ecological parameters, primarily; climate, physiography, parent soil material, surficial soil, and vegetation.

Tree: a woody plant, usually with a single main stem, capable of exceeding 10m in height. For the purpose of this inventory, a tree is defined as a species listed in Appendix B: Vegetation Resources Inventory Tree Code List; longer than 1.3m with the roots attached to the bole; larger than 4.0cm DBH.

Tree Cover Pattern: describes the spatial distribution of the tree cover within each tree layer in the polygon.

Variable Area Plot Sampling Method: a method of timber cruising commonly used for industrial timber cruising in which sampling area (plot size) varies with tree diameter.

Vegetated Polygon: a polygon is considered Vegetated when the total cover of trees, shrubs, herbs, and bryophytes (other than crustose lichens) covers at least 5% of the total surface area of the polygon.

Volume: average gross stem volume of all living trees in the dominant, co dominant and high intermediate crown positions. It is expressed in cubic meters per hectare.

Wetland Designation: land having the water table near, at, or above the soil surface, or which is saturated for a long enough period to promote wetland or aquatic processes. Poorly drained soils, specialised vegetation, and various kinds of biological activity indicate these processes, which are adapted to the wet environment.

Wildlife Tree: dead, decaying, deteriorating, or other designated trees that provide present or future habitat for the maintenance or enhancement of wildlife.

WPV- Within-Polygon Variation Sampling: is a series of plots located within target polygon, designed to measure the variation (expressed as a percentage) that exists within a "homogeneous" polygon.

FOREST DISTRICT VRI IMPLEMENTATION TACTICS

District: Prince George

Year	Task	Output Level	Funding $
2002	Phase 2 Sampling	50 samples	100,000
2002	NVAF Sampling Compilation	250 trees Report	100,000 10,000
2003	Prepare Strategic Inventory Plan – Photo Acquisition	Plan 1:30000 colour	15,000 460,000
2004	Phase 1 Classification & Mapping	500,000 ha	750,000
2005	Phase 1 Classification & Mapping	500,000 ha	750,000
2006	Phase 1 Classification & Mapping	500,000 ha	750,000

District: Robson Valley

Year	Task	Output Level	Funding $
2002	Prepare VRI Strategic Inventory Plan	Plan	15,000
2003+	To be determined		

District: Vanderhoof

Year	Task	Output Level	Funding $
2002	Phase 2 Sampling	100 samples	200,000
2002	NVAF Sampling	210 trees	85,000
2002	Data Compilation / Analysis / Adjustments		15,000
2003	Monitoring Plots WPV Samples Compilation	100 samples 30 polygons	200,000 90,000 10,000

District: Fort St. James

Year	Task	Output Level	Funding $
2002	Prepare Strategic VRI Plan	Plan	15,000
2002	Phase 2 Sampling Compilation & Analysis	200 samples	500,000 10,000
2003	NVAF Sampling Compilation & Analysis	150 trees Report	75,000 5,000

District: Mackenzie

Year	Task	Output Level	Funding $
2002	Fieldwork / Photo Interp. / Mapping (VRI Phase 1)	300 maps	1,957,000
2003	Delineation / Fieldwork / Photo Interp. / Mapping Sample Plan Preparation	45 maps	955,000 15,000
2004	Phase 2 VRI Sampling	180 samples	312,000
2005/06	Phase 2 NVAF Sampling WPV Sampling Monitoring Plots QA	170 trees 30 polygons 100 samples	85,000 45,000 145,000 27,500

District: Dawson Creek

Year	Task	Output Level	Funding $
2002	Preparation of a Strategic (holistic) Inventory Plan	Plan	15,000
2002	NVAF Balsam Trees Compilation / Analysis	60 trees Report	24,000 5,000
2003	VRI Phase 1 Moberly	500,000 ha	750,000

District: Fort St. John

Year	Task	Output Level	Funding
2002	Phase 1 Classification / Mapping (Sikanni Area)	750,000 ha	1,000,000
2003	Phase 1 Classification / Mapping (Fontas Area)	750,000 ha	1,000,000
2004	Phase 1 Classification / Mapping (Retrofit Area)	1,000,000 ha	1,000,000
2005	Phase 2 Sampling Sample Compilation	235 samples Report	500,000 10,000
2006	NVAF Sampling Compilation / Analysis	250 trees Report	125,000 5,000

District: Fort Nelson

Year	Task	Output Level	Funding
2002	Phase 2 Sampling Compilation Monitoring Plots	150 samples Report 50 samples	525,000 15,000 75,000
2003	Phase 2 Sampling Compilation	50 samples Report	175,000 10,000
2004	NVAF Sampling Compilation & Analysis	150 trees Report	150,000 10,000
2005	Prepare VRI Strategy Plan WPV Sampling	Plan 30 polygons	20,000 120,000

TFL: 48 VRI Implementation Strategy

Year	Task	Output Level	Funding
2002	Phase 2 Sampling	30 samples	60,000
2002	NVAF Sampling	150 trees	75,000
2003	Phase 2 Sampling	75 samples	150,000
2004	WPV Sampling	20 polygons	75,000

ISSUE 2: INCOMPLETE CARIBOU MANAGEMENT OBJECTIVES

Overview Description of the Regional Strategic Issue:

Caribou management is a high profile issue in the Prince George Forest Region. Caribou management has been segregated from the management of other "at-risk" species because they are so highly valued by the public and because they have a more obvious and direct response to, and impact on, forestry operations. They are Nationally listed as a Threatened species. Existing information on caribou habitat needs and population dynamics is inadequate.

Relationship to Sustainable Forest Management:

The maintenance of environmental values:

Forest operations will affect the distribution and abundance of caribou populations and the health and well being of individual caribou. Caribou could be eliminated from areas or their numbers reduced if logging reduces their food, increase predation rates, increases disturbance that leads to increased energy expenditure or avoidance of areas with human activity. There are 5 areas where the outcomes of forest management decisions are uncertain and where data would substantially improve our ability to predict outcomes and make optimum decisions:

caribou population surveys

future suitability of managed stands for caribou

determination of the division between northern and mountain life history strategies

lichen responses to various management techniques

human disturbance impacts

The sustainable use of timber resources:

Forest management only for caribou would lead to a) uncertainties in forest development planning, b) increased operational costs, and c) a direct reduction in the timber supply.

The sustainable use of non-timber resources:

Forest development decisions affecting caribou management would also affect a) Aboriginal hunters, guides, trappers, resident hunters, and people using the forest for other forms of recreation, b) other species such as moose and grizzly bears, and c) other industries operation on the forest such as mining, and petroleum extraction.

Relationship to Strategic Resource Plans and Decisions:

Strategic Decisions:

Completing basic census information and identifying habitat requirements and occurrence of features and required reserves will directly improve upcoming timber supply review decisions by allowing for simultaneous habitat supply analyses. These paired analyses will identify specifically where (within the THLB) and when conflicts in management cannot be resolved through planning thereby providing insight into potential withdrawals from or additions to the availability of timber as a result of at risk wildlife and wildlife habitat maintenance or enhancement activities. Strategic Resource Plans

While all Omineca-Peace LRMP's provide direction on caribou and caribou habitat management, inadequate basic information and an inability to predict the outcome of management decisions hamper implementation of this direction.

The development and implementation of other plans, policies and procedures (i.e. DM policies, SOP's, SFM Plans, LUP, IWMS, IFPA's, provincial grizzly management strategy, Identified Wildlife requirements, Muskwa-Kechika guidelines) will be improved and managers will be better able to monitor and adapt their management as appropriate.

TSR II is currently fully underway in the Omineca-Peace Region. With the completion of the Mackenzie LRMP in 2000, all LRMP's in the Omineca-Peace Region are now currently being implemented. The other strategic plan initiatives listed are currently either under development or are being implemented –

the knowledge strategies are relevant now for plan development and monitoring and their value will increase over time.

Cross Reference to Management Unit Issues:

We know more about the implications of caribou management decisions in some areas than others. More is known about mountain than northern caribou. Boreal caribou are the least known of the 3 ecotypes.

Recommended Knowledge Solution:

Three knowledge building solution strategies are recommended which combine use of existing information and knowledge with the collection of new data and information:

Strategy 1. Regional Caribou Population Inventory

Caribou size and trend information (Tactic 1) and investigation of the division between northern and mountain life history (Tactic 2) need to be addressed first in order to contribute to caribou recovery plans. Caribou size and trend information needs to be collected everywhere across the Region; whereas, looking at the division between northern and mountain life history strategies should be focused in the central Rockies.

Strategy 2. Caribou Habitat Prediction

Efforts to address the future suitability of managed stands for caribou (Tactic 1) and study of lichen response to different forest management practices (Tactic 3) should be conducted as research trials in both a northern and mountain caribou habitat area. Assembly of local population and habitat use information (Tactic 2) should support both tactics.

Strategy 3. Human Disturbance Impact Research

Investigations of human disturbance impacts on caribou (Tactics 1, 2, 3 and 4) need to be conducted in both a northern and mountain caribou habitat area.

In terms of extension activities, we need to identify audiences and user groups and their needs and strengthen extension efforts.

Ongoing research priorities and monitoring activities will be identified as knowledge activities are undertaken. Specifically, there is a need to monitor the success of existing wildlife strategies, build and test decision-based habitat supply models.

Status of Existing Knowledge:

Organisation, synthesis and analysis:

Tools for analysis and inventory already exist to document caribou habitat use, lichen response to management and caribou disturbance but caribou census techniques and synthesis habitat and demographic models need to be developed.

Inventory:

Caribou habitat use data are available for a few areas but not enough to account for variation among areas, seasons, etc. Only crude caribou herd size and trend estimates are available and then only for a small fraction of the Forest Region. Specifically, we have habitat studies for herds in the southern Mackenzie and Fort St. James Districts, Entiako herd, and mountain caribou populations; however, there is little information available for the Peace River herds, and more northerly herds.

Disturbance impacts can take many forms. Some information from Alberta is available that addresses how caribou distribute themselves with respect to roads but no information is available concerning range abandonment or the population consequences in relation to the level of human activity. No information is available on the life history of caribou in the transition area between mountain and northern caribou. Some information exists on lichen response to various management options but we need to account for variation in those responses in different areas and to both terrestrial and arboreal lichen.

Extension:

Most of the existing information is available only in academic publications and theses and needs to be revised for field manuals and accompanying management specific documentation.

Research:

Certainly much has been done but much more is necessary. Habitat studies are especially required for Peace River herds and more northerly herds.

Monitoring:

All herds need ongoing population monitoring to address their threatened population listing.

Strategic Performance Indicators, Targets & Milestones:

The suite of three strategies is designed to be implemented simultaneously over the five-year period of the strategic plan. Specific performance indicators, targets and milestones are described by tactic, within each strategy.

Relationship to Other SSFM Knowledge Strategies (if applicable):

The issue of caribou management is related to many other issues within this resource management plan. In particular,

Better habitat inventories (RMP issue #1) provide better habitat classifications for caribou and therefore are an important tool

Management of species at risk and general wildlife (RMP issue #3&4) are of course related to the issue of caribou management. Integrated management strategies for a variety of species, including caribou, should be the objective.

Emulating natural disturbance patterns (RMP issue #5) for biodiversity conservation is also a desirable strategy for caribou management.

In terms of staging investments over time, clearly we need to develop census techniques before we can determine size and trend. We need to determine caribou life history in the transition zone before examining the lichen responses to management (i.e., if terrestrial lichens are not used then we do not need to determine terrestrial lichen responses).

Strategy 1: Regional Caribou Population Inventory

Tactic 1	Regional Caribou Herd Census

Tactical Summary:

The entire Omineca-Peace Region requires additional support for ongoing winter surveys of mountain caribou and wildlife managers must develop a suitable survey technique to accurately and precisely determine northern caribou herd size.

Status:

This is part of an existing/ongoing strategy.

Tactical Objectives:

Population size and trend is unknown but required to assess effectiveness of decisions. Priority is for those populations most directly affect by logging and those at most risk because of low current numbers (e.g., Wolverine, Chase and Graham herds).

Tasks, Deliverables, Targets and Milestones (Tactical):

This tactic will be implemented via a number of co-ordinated, operational herd census projects. The specific products and expected outcomes are population status reports. Ongoing (annual or periodic) population monitoring will be necessary.

Cost Sharing:

Regional wildlife staff will be available to help devise census strategies. First Nations will be interested in the data and may be willing to contribute to achieving this objective. Logging companies interested in numbers of caribou in their operating areas.

Partnerships:

Possible partnerships include First Nations and forest licensees.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
25 000	annually	60 000	60 000	60 000	60 000	60 000	300 000	5

Tactic 2	Central Rocky Mountain Comparative Ecology Study

Tactical Summary:

Woodland caribou in the southern mountains of British Columbia are nationally listed as "Threatened". The herds in the central Rocky mountain eco-region are the least well understood of all of these threatened caribou within B.C. This area represents the transition zone between the mountain ecotype and northern ecotype of woodland caribou. These two ecotypes of caribou are adapted to different natural disturbance regimes, and consequently require different forest management practices.

The purpose of this knowledge tactic is to understand the relationships between habitat and caribou ecology within the central Rockies and recommend appropriate habitat management strategies for different herds within this area to achieve LRMP objectives.

Status:

This is a new strategy.

Tactical Objectives:

This initiative will contribute to Strengthening Sustainable Forest Management by identifying the distribution, status and habitat requirements of threatened woodland caribou populations in the central Rocky Mountains eco-region. Caribou herds within this area are the least well understood of all the caribou herds that constitute the nationally threatened southern mountain caribou population because all of the other herds have been the subject of major radio-telemetry studies in the past. The provincial status of the herds in the central Rocky eco-region is classed as unknown, whereas the status of most other herds is known.

This issue is also of interest because it represents the transition zone between the "northern ecotype" and the "mountain ecotype" of woodland caribou. These two ecotypes have drastically different habitat requirements so it is important to know which forest management practices are appropriate for the different caribou herds within this area. The study will also contribute to our understanding of the more general relationships between habitat characteristics and different habitat use patterns of woodland caribou across their range.

Tasks, Deliverables, Targets and Milestones (Tactical):

The mountain ecotype of woodland caribou feed almost exclusively on arboreal lichens in old-growth ESSF forests during the winter. Partial cutting prescriptions have been developed to perpetuate this habitat type within managed forest landscapes. In contrast, the northern ecotype of woodland caribou feed primarily on terrestrial lichens in mature pine forests at low elevations, or windswept alpine areas. Even aged management, large patch sizes and extended rotations are recommended to perpetuate this habitat on managed landscapes. Within the study area, the habitat use patterns of caribou are not well known so consequently, it is not know which forest management strategy is appropriate for different areas. This effort will identify which silvicultural system is appropriate to perpetuate caribou habitat in different areas.

Year 1, 2001-2002

In the first year 20 adult, female caribou will be captured across the study area, and outfitted with VHF radio-collars. Caribou will be captured throughout the study area using a variety of capture methods including net-gunning in the alpine during the rut, net-gunning or darting on low elevation early winter ranges, and net-gunning in the alpine during winter. This will ensure that caribou representing a range of seasonal use strategies are included in the sample. Collared caribou will be located biweekly by aerial telemetry to determine movements and habitat use. Locations will be determined with a GPS and additional data including group composition will be recorded. GPS co-ordinates will be entered into a GIS for home range and habitat analyses.

During the winter months (November-March), a sample of the collared caribou using different habitat types (i.e. alpine, subalpine forests, low elevation forest, clearcuts) will be located on the ground and trailed through the snow to determine feeding activity, i.e. arboreal lichens, terrestrial lichens or vascular plants. Snow depth along the foraging route, and depth of foraging craters will be measured. The movement routes and feeding locations will be recorded on a GPS.

Any collared caribou that die will be necropsied as soon as possible to determine the cause of death. Blood samples from captured caribou will be analysed for progesterone concentrations to determine the pregnancy rate.

Year 2, 2002-2003

In the second year, monitoring of the collared caribou will continue as above. Calf survival will be determined during calf surveys from a helicopter in June, October and March. Additional caribou will be captured and collared in the second winter. Data from the first year will be used to target the capture effort to areas where the existing collared sample is inadequate. In addition, 5 GPS collars will be placed on caribou that represent a range of habitat use patterns based on their previous year's movements. The GPS collars will be programmed to record 4 locations/day, and will be downloaded every 3 months to retrieve the data. The objective will be to have 20 VHF and 5 GPS collars on caribou for the duration of the project.

Year 3, 2003-2004

Monitoring of collared caribou and ground trailing will continue as above. Calf counts will be conducted and adult mortality will be investigated. Additional caribou will be captured during the winter to maintain the sample at 20 VHS and 5 GPS collars.

Cost Sharing:

Regional wildlife and MoF staff will be available to help devise census strategies.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		200 000	200 000	200 000	200 000	200 000	1 000 000	5

Strategy 2: Caribou Habitat Supply Modelling[1]

Tactic 1	Caribou Habitat Supply Model Development
Tactic 2	Local Information Assembly

Tactical Summary:

We need to develop a caribou habitat supply model that will support management decisions and that is based on inventory data and our understanding of ecological systems. Models should apply to the entire region.

Stakeholders in Mackenzie have undertaken a multi-year project "Ecological Factors Affecting Northern Caribou in the Omineca Region, BC" to address caribou and caribou habitat, for which resultant information and decision support tools may be applied in other parts of the Omineca-Peace region. The vision adopted throughout this project has been "to provide a comprehensive inventory of caribou and habitat values that through decision modelling, is used to aid strategic, land-management in the TSA allowing for sustainable resources management (LRMP), but also could address industrial certification initiatives, COSEWIC recovery plans for threatened species, and timber supply reviews" (McNay, 2001).

The objectives for this project remain as they were initially stated (McNay 1999) and are repeated here for context:

- provide basic inventory information concerning abundance, seasonal movements, and habitat needs of large ungulates where such basic information could then lead to better assessments of habitat values for these species;

- provide standard expressions of, or procedures for verifying, Wildlife Habitat Assessments where increased confidence in these assessments could then lead to better strategic planning for integrated management of forests and wildlife;

- develop, implement, and monitor a strategic management plan for Caribou (i.e., LRMP's "Caribou Management Strategy").

- aid subsequent development of, and discussion about, adaptive management initiatives with industry, government, First Nations, and local communities.

Status:

This recommendation is part of an existing/ongoing strategy (e.g., the Omineca Northern Caribou Project).

Tactical Objectives:

Objectives are to:

predict the suitability of managed stands for future caribou habitat (Tactic 1).

collect information on caribou selection for different habitat attributes (Tactic 2).

document the development of those attributes in managed stands (Tactic 3).

Tasks, Deliverables, Targets and Milestones (Tactical):

The deliverable is localised predictive models of caribou habitat supply. The recommended target completion date is March 31, 2007.

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[1] Tactic 1 and 2 of this strategy are presented together since their cost estimates are difficult segregate. Actual costs for each tactic may vary depending on local circumstances.

Partnerships:

Partnerships with government and logging companies will definitely be required

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
6 000 000	Since 1996	500 000 to 1M	500 000 to 1M	500 000 to 1M	500 000 to 1M	500 000 to 1M	2.5 to 5M	5

Tactic 3	Managed Stand Caribou Habitat Research

Tactical Summary:

In concert with Tactics 1 and 2, to develop a caribou habitat supply model that will support management decisions and that is based on inventory data and our understanding of ecological systems.

Lichen woodlands are generally located on lower elevation alluvial terraces that have a dominant overstorey of lodgepole pine and have very coarse textured soils. Terrestrial lichens, which provide caribou the bulk of the caribou's winter diet, are naturally predominant in 70 to 140-year-old stands. The dominance of these lichens is a function of severe growing conditions at a site, which impedes the growth of vascular plants and bryophytes. There is limited information available regarding the impacts of forestry on pine-lichen winter ranges. Thus, there is a need to improve understanding of management paradigms regarding the implementation of forestry activities on the associated forest types, specifically how do various forest practices influence lichen retention and growth response in different environments. This knowledge is required for the entire region and for both arboreal and terrestrial lichens

Status:

Within the Mackenzie Forest District a 'caribou model' is being developed under the Omineca Northern Caribou project. The model incorporates Bayesian belief networks and a geographic information system to determine the value of a caribou herd range considering different landscape disturbance regimes. One component of this model is a pine-lichen winter range sub-model. This sub-model evaluates four key elements to determine the value of terrestrial lichen sites for caribou use. These elements are lichen habitat capability, stand overstorey characteristics, forest floor characteristics and the utility of the stand for caribou use.

Work is under way in the Vanderhoof and Mackenzie Forest Districts to collect and evaluate information on two elements of the sub-model, the stand overstorey characteristics and the forest floor characteristic nodes. These are used to express the condition of the microclimate and the growing medium at a site, both of which are modified through forestry practices. Improving our understanding of the factors influencing the distribution ecology of terrestrial lichens result in a more reliable sub-model that can be used to manage for caribou and forestry resources. The Vanderhoof and Mackenzie Forest District are not representative of all ecosystems in the PG Forest District so some work will also be required where the results are unlikely applicable but those areas are not known at present.

Tactical Objectives:

To produce a tool to assist in the management of forestry and caribou resources that will incorporate information from a variety of different silviculture treatments and their effects on lichen development so that treatments can be chosen which create conditions most suitable for retaining and promoting lichen growth after logging. An addition objective is to validate parameters and test the robustness of the PLWR sub-model of the Mackenzie Caribou model.

Tasks, Deliverables, Targets and Milestones (Tactical):

The deliverable is a decision-based lichen management model for both terrestrial and arboreal lichens in all BEC zones, by March 31, 2007.

Sampling will monitor changes of the vegetation complex from pre-harvest conditions will form the baseline from which changes are measured.

A detailed monitoring plan for each study site during the full summer after treatments are completed and then for the next two subsequent summers. Additional monitoring will be conducted in year 5.

Disturbance to the soil and the surface ground cover needs to be assessed as will the accumulation of slash which could cover the lichen mat with debris and result in lichen mortality, which will reduce their overall abundance.

Partnerships:

Partnerships with MOF and WLAP and logging companies will definitely be required.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		200 000	200 000	200 000	150 000	150 000	900 000	5

Strategy 3: Human Disturbance Impacts[2]

Tactic 1	Human Disturbance Problem Analysis
Tactic 2	Short Term Population Monitoring
Tactic 3	Medium Term Animal Response Research
Tactic 4	Long Term Population Response Research

Tactical Summary:

Increasing traffic in the backcountry has been accompanied by mounting concerns about the effects of those activities on wildlife populations in general, and in particular, on caribou winter habitat use and survival. Recreation activities such as snowmobiling and helicopter use, relative to other backcountry activities have the greatest perceived threat to caribou because of the infringement on high elevation habitat. Disturbance impacts range from more obvious short-term disturbance (i.e. animals fleeing from human presence and noise, causing temporary habitat displacement), to more subtle and complex impacts (i.e. hard-packed snowmobile trails allow easy access for predators like wolves to reach subalpine foraging areas, which are typically inaccessible to then due to deep snow).

Investigations into the short term, mid-term, and long-term impacts of human disturbance (primarily snowmobiling and helicopter activities) are required to enhance management guidelines. Management guidelines based on caribou ecology are required to minimise adverse disturbance impacts on the distribution and abundance of caribou. Work is required across the entire Omineca-Peace Region to address this issue.

Status:

Overall, the scientific literature and knowledge base on the impacts of snowmobile and helicopter activity on caribou is somewhat limited. However, the primary concern regarding human disturbance impacts on caribou relates to snowmobiling, where the threat to caribou lies in the displacement from preferred late winter foraging areas, which can result in a decline in physical body condition due to reduced forage intake and increased energy expenditure (Simpson et. al., 2000).

Tactical Objectives:

A very broad objective of investigating human disturbance impacts on caribou is to identify key management issues, provide interim management guidelines, and outline research needs. The ultimate objective is for wildlife managers to understand disturbance impacts and to define acceptable levels of activities/ thresholds, so as to minimise disturbance levels to non-detrimental levels.

The issue of disturbance is complex. Responses to disturbance are related to a variety of factors (disturbance type, intensity, frequency, caribou herd size, reproductive status, habitat elevation, distance from cover etc.). Before we can mitigate human disturbance impacts on caribou, we must first increase our understanding about the actual effects of snowmobiling and helicopter use on caribou. Thus, a primary objective is to clearly document the impacts of these backcountry activities on caribou at three different scales. (Wilson et. al., 2001) discuss human disturbance impacts in terms of the following spatial-temporal scales:

Short-term acute responses – immediate and short-term duration response (behavioural disruption). For example, we need to investigate impacts such as temporary range abandonment, impact on foraging, cow-calf disruptions, etc.

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[2] Tactics 1 to 4 of this strategy are described together, and cost estimates are not segregated. A realistic cost for completion of Tactic 1 during the first year is $25 000. Completion of Tactic 1 will largely determine the remaining costs of implementing the strategy.

Medium-term chronic responses – these impacts develop more slowly over time, but do not dissipate as the short-term acute responses. For example, we need to investigate impacts such as permanent range displacement, chromic behaviour impacts leading to changes in movement pattern and habitat use, predator access to winter ranges etc.

Long-term demographic impacts – the objective in assessing long-term demographic impacts is to determine whether there are differences in key population parameters between disturbed and non-disturbed areas . For example, we would be assessing long term absence of caribou from suitable winter range, disruption of foraging, social organisation, or other life history activities that point to a threat for long-term viability of populations.

To address human disturbance impacts on caribou at these three scales we must first design an adaptive management framework that will address the following key questions (from: Simpson et. al., 2000):

What level of backcountry use results in range abandonment?

What level of backcountry use results in habitat displacement (i.e. caribou switching use of certain ridges)?

What level of backcountry use results in directional movement from high disturbance to low disturbance areas?

How often do caribou run in disturbed and undisturbed habitats?

Are predators more often present on disturbed ranges than on undisturbed ranges?

Tasks, Deliverables, Targets and Milestones (Tactical):

A preliminary task to investigating human disturbance impacts on caribou would include a scientific and wildlife management literature review, of both impacts and management guidelines. Extensive discussions with wildlife professionals would also be an important component of assessing impacts of disturbance and effectiveness of management strategies. In terms of research studies, a variety of methodologies used to study disturbance effects are needed. Research should be stratified into phases that correspond to spatial and temporal scales of animal responses to disturbance.

1) Immediate (short-term acute) responses could be quickly and economically assessed during aerial surveys. Further investigations into the short-term behavioural responses of caribou may require a 2-year project timeframe ranging from $100,000 to 150,000 investment. Collecting additional information of pre and post disturbance behaviour would be ideal, but may be logistically difficult and more expensive.

2) Effort to investigate medium-term chronic responses (i.e. range abandonment) could entail use of radio-collaring methods and would typically require a timeframe of 5 years, focusing on comparing range and movement characteristics between control and disturbance areas. Estimated costs range from $400,000 to $550,000.

3) Objectives of a longer-term investigation and population impacts would be to determine whether there are differences in population parameters between disturbed and non-disturbed areas. A 5-6 year timeframe ranging from $200,000 to $300,000 maybe needed. However, some long-term, demographic differences can be assessed through detailed annual surveys and analysis of age-class ratios. Much of the information required to refine management guidelines and to address knowledge gaps identified in the literature review can be collected during aerial surveys (Wilson et. al., 2001).

Results of investigations should be reviewed and guidelines developed and updated as required.

Cost Sharing:

Cost sharing opportunities with possible partners should be explored (see below). Priority should be given to securing funding for aerial surveys, since both short-term acute and long-term demographic human disturbance impacts on caribou can in part be assessed by analysis of detailed annual survey data.

Partnerships:

Possible partnerships with Forest Licensees, Community Groups, UNBC, MSRM, MWLAP.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	100 000	100 000	100 000	500 000	5

Literature Cited:

Simpson K., and E. Terry. 2000. Impacts of Backcountry Recreation Activities on Mountain Caribou. BC Ministry of Environment, Lands and Parks. Wildlife Working Report No. WR-99.

Wilson S. F., and D. M. Shackleton. 2001. Backcountry Recreation and Mountain Goats: A Proposed Research and Adaptive Management Plan. Wildlife Research Group. University of BC Vancouver, BC.

ISSUE 3: LACK OF SPECIES-AT-RISK MANAGEMENT OBJECTIVES

Overview Description of the Regional Strategic Issue:

Improving the reliability, completeness and consolidation of habitat information for identified species-at-risk will enhance the ability to establish clear and measurable management objectives for the sustainable management and enhancement of these species' populations and their habitats today, and enable the monitoring and adaptation of management objectives in the future.

Relationship to Sustainable Forest Management:

The maintenance of environmental values

Grizzly bear, wolverine, fisher, arctic grayling, bull trout, white sturgeon and various raptor and songbird populations, and the availability and integrity of their habitat, are potentially at risk from human activities, and an understanding of forestry related effects is uncertain. The census is incomplete for populations, as is habitat information for these wildlife species. Inadequate or unreliable knowledge prevents the definition of clear and measurable management objectives, thereby frustrating effective management planning. Without a means of projecting the future supply of habitat for these wildlife species, a management strategy for most forest units is impossible.

Filling the following knowledge gaps...

Status of life history knowledge

Population status

Distribution

Mapping

Management/ Modelling tools

Level of impact from forestry

Predicting occurrence

... would substantially improve decision making by introducing more certain and complete basic information/ data, enabling the development of management options and a much more accurate evaluation of the implications of management decisions through:

Filling specific information gaps on life history, habitat requirements, geographic distribution and sensitivities of specific species

Improving our understanding of certain wildlife species' and habitats' sensitivities to forest development activities

Developing data tracking systems that enable data compilation, analysis and data sharing

Developing accessible and useable predictive models

Monitoring the implementation of existing wildlife management strategies or developing them where none currently exist

Evaluating habitat and population related assumptions

The sustainable use of timber resources

For the most part these risks and uncertainties are related to operational costs, measurement of performance, and diminishing timber availability due to withdrawals from the timber supply. Some of the more significant timber supply related risks and uncertainties exist in the following areas:

Wildlife tree retention, old growth management area, WHA's and SA's, other deferral areas and other wildlife habitat related reserves

Clarity around the needs of certain at risk species

Road access

Geographic distribution of at risk species

Timing windows for operations in sensitive habitat areas or around sensitive features

The sustainable use of non-timber resources

Likely, the most significant risks and uncertainties for users of wildlife that might be impacted by forestry/ wildlife interactions and the sensitivity of these at risk species include:

First Nations – wildlife population information related to sustainable use levels of wildlife and information on the distribution of hunting opportunities are necessary knowledge, which may ultimately affect treaty negotiations.

Hunting & Fishing – e.g.,. grizzly bears are one of the highest priority species relating to hunting management, and further information is needed to base management decisions on.

Recreationists and Tourists- e.g.,. backcountry hiking & camping, all terrain vehicle use etc.

Guides and trappers

Risks and uncertainties include access management; sport and commercial catch limits, maintenance of other forest values (i.e. viewscape, water quality).

Relationship to Other SSFM Knowledge Strategies (if applicable):

Strategic Decisions

Completing basic census information and identifying habitat requirements, features and required reserves will directly improve forthcoming timber supply review decisions by providing insight into potential withdrawals from or additions to the availability of timber as a result of at risk wildlife and wildlife habitat maintenance or enhancement activities.

Strategic Resource Plans

All of the Omineca-Peace LRMP's provide direction on the management of species at risk and their habitat. The implementation of this direction is currently hampered by the inadequacy of basic information on the presence/absence of these at-risk species, the lack of information on the sensitivity of certain species and the absence of readily available tools to model the likely outcomes of management decisions.

The development and implementation of other plans, policies and procedures (i.e. DM policies, SOP's, SFM Plans, LUP, IWMS, IFPA's, provincial grizzly management strategy) will be better informed and managers will be better able to monitor and adapt their management as appropriate.

Relationship to Strategic Resource Plans and Decisions:

TSR II is currently fully underway in the Omineca-Peace Region. With the completion of the Mackenzie LRMP in 2000, all LRMP's in the Omineca-Peace Region are now currently being implemented. The other strategic plan initiatives listed are currently either under development or are being implemented – the knowledge strategies are relevant now for plan development and monitoring and their value will increase over time.

Cross Reference to Management Unit Issues:

Specific information needs (distribution, risk assessment) will be identified at the management unit level, as the knowledge strategy is implemen6ted. There will be a need to recognise unique management unit knowledge needs and opportunities due to wildlife habitat variation across the region. The need for management unit specific knowledge will be identified through the prioritisation of knowledge gathering activities at a scale that is appropriate for addressing the management concern.

Status of Existing Knowledge:

Organisation, synthesis and analysis:

PEM and TEM exist and have been completed for only a very small portion of the Omineca-Peace Region (see Issue 1).

Inventory:

Table 3.3.1 presents a summary of the status of knowledge for all species at risk. The Tactical Planning Committee recommends that the status of existing information on each species be undertaken as a priority.

Extension:

Some extension activities have been undertaken at the provincial and regional levels for a selection of the at risk species. These extension activities have always been well received and participants always observe that more needs to be done.

Research:

Some research has been completed for a variety of sub-issues, additional research will likely be necessary – needs must be identified and prioritised at appropriate scales.

Monitoring:

Some monitoring has taken place, additional monitoring needs to be undertaken. Development of monitoring systems as well as using existing systems needs to be undertaken.

Recommended Knowledge Solution:

General Approach:

Improving our understanding of certain wildlife species' and habitats' sensitivities to forest development activities is dependant upon existing information as well as the collection of new information. Developing accessible and useable predictive models is also dependent upon existing and new information. Related to this is the importance of focusing efforts on the sharing of technical expertise amongst professionals and between forest districts in the Region.

More Effective Use of Existing Information

Developing data tracking systems that enable data compilation, analysis and data sharing build upon existing information. Developing accessible and useable predictive models also builds upon existing knowledge, although the existing knowledge may have to be converted and/or verified. Evaluating habitat and population related assumptions and monitoring the implementation of wildlife management strategies also utilises existing information.

Gathering New Information

Strategies that fill specific information gaps on life history, habitat requirements, species specific sensitivities, and forestry related impacts, would significantly improve our ability to develop management scenarios, make informed management decisions, enable the monitoring and adaptation of management decision and assess the risk associated with management activities and decisions. Ensuring that this information is available to other stakeholders would facilitate this process.

The recommended knowledge solution employs two basic knowledge strategies: collection of new information; and more effective use of existing information.

Recommended Species-specific Strategies

This knowledge solution is comprised of a suite of four species-related strategies. The principle factors differentiating the strategies are:

Relative sensitivity to forest development activities; and

Relative state of knowledge of the species

The four resulting strategies address each of the following four categories of species:

Species-at-risk that are highly sensitive to forestry activities and for which very little information is currently known about them (little knowledge);

Species at risk that are highly sensitive to forestry activities and for which some knowledge building initiatives have been undertaken that need to be completed or extended (imperfect knowledge);

Species at risk that are moderately sensitive to forestry activities and the status of knowledge about these species varies (imperfect knowledge); and

Species at risk that have low sensitivity to forestry activities and the status of knowledge about these species varies (imperfect knowledge).

While all of the knowledge activities are of significant priority due to the risks to and sensitivities of the identified species, priority should be give first to the species that are in the first category – it should be noted that within each category, the individual species are not prioritised.

While investment funds and scientific capacity are real constraints to strategic implementation, nevertheless there is a need to address multiple strategies, tactics and projects simultaneously.

Applicable to species-at-risk in all categories is the common objective of maintaining habitat quality and diversity, protecting key habitats, and establishing Wildlife Habitat Areas in accordance with the Managing Identified Wildlife Strategy.

Strategic Performance Indicators, Targets & Milestones:

Strategic performance indicators vary by species-at-risk category and by species within each category. Specific information is provided in Tactical descriptions.

Relationship to other SSFM Knowledge Strategies

Each of the four species at risk strategies is linked to the following other SSFM strategies:

Vegetation Resources Inventory Strategy
Ecosystem Mapping Strategy
Fish and Fish Habitat Management Strategies (3)
Decision Support Tools Strategies
Sustainable Harvest Strategies within each forest district.

Table 3.3.1 Status of Inventory and Habitat Knowledge for Selected Species at Risk

Name	Level of Impact from Forestry (H,M,L)	Population Status	Status of Life History Knowledge	Distribution	Mapping	Management Modelling Tools Available	Prediction of Occurrence
Long Eared Myotis	H	Unknown	Unknown	Largely unknown	Unavailable		
Wolverine	M	Partial [3](non-Mackenzie)	Specific information	Largely known	Suitable and critical habitat mapping largely unavailable – under development in some areas		
Grizzly	M	Known	Known	Largely known	Suitable and critical habitat mapping largely unavailable – under development in some areas		
Arctic Grayling	H	Partial	Partial	Partial	Partial	0	
Bull Trout	H	Partial	Partial	Partial	Partial		
White Sturgeon	M	Partial	Partial	Partial	Partial		
Fisher	M	Partial	Partial	Known	Partial		
Peregrine Falcon	L	Partial	Unknown	Unknown	0		
Short-Eared Owl	L to M	Unknown	Partial	Unknown	0		
Broad Winged Hawk	H	Unknown	Partial	Unknown	0		
Warblers:							
Bay Breasted	H	Unknown	Unknown	Unknown	0		
Cape May	H	Unknown	Unknown	Unknown	0		
Connecticut	H	Unknown	Partial	Partial	0		
Black-Throated Green	H	Unknown	Partial	Partial	0		
Canada	M	Unknown	Partial	Partial	0		
Nelson's sharp-tailed sparrow	L	Unknown	Partial	Partial	0		

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[3] Partial = incomplete understanding re: distributions or life histories

Laconte's sparrow	L	Unknown	Partial	Unknown	0		
Philadelphia vireo	M	Unknown	Partial	Unknown	0		
Trumpeter Swan	L	Partial	Known	Known	0		
American White Pelican	L	Known	Known	Partial	0		
Surf Scoter	L	Unknown	Known	Partial	0		
Upland Sandpiper	L	Unknown	Unknown	Unknown	0		
Long Billed Curlew	L	Partial	Partial	Partial	0		
Lewis' Woodpecker	L to M	Unknown	Unknown	Unknown	0		
Plants and plant associations	Varies	Unknown	Unknown	Unknown	0		
Sandhill Crane	L to M	Unknown	Known	Partial	0		
Great Blue Heron (herodias subspecies	M to H	Unknown	Known	Unknown	0		

Strategy 1: Knowledge of High Sensitivity/ Little known Species-at-Risk

Tactic 1	Improving Species Knowledge of the Long Eared Myotis

Status of Knowledge:

Relative to our state of knowledge on other species at risk, virtually nothing is known about the habitat, population status and distribution of the long-eared myotis in the Omineca-Peace Region

Activity Summary:

Initially, the long-eared myotis' roosting and foraging habitat requirements need to be more clearly defined – marking and tracking projects (mist-netting and radio telemetry will be essential components of this work) should be concentrated in one region initially to learn more before region wide efforts are made. After initial efforts to characterise habitat needs the focus should be on range-wide inventories of distributions and habitat use, establishing graphic representations of this to enable managers to predict and follow up on occurrences, and establish management regimes aimed at maintaining habitat in sufficient quantity to maintain M. septentrionalis populations.

Status:

New;

Relative to our state of knowledge on other species at risk, virtually nothing is known about the habitat, population status and distribution of the long-eared myotis in the Omineca-Peace Region.

Activity Objectives:

To determine habitat requirements (attributes and distribution) throughout the region;

To determine population status and assess the degree of risk to this species within the region.

Tasks, Deliverables, Targets and Milestones:

Identify management units where long eared myotis occurs

Identify key habitat elements where they occur, by forest district

Record and identify patterns regionally, and district-specific variations

Timeframe: 4-5 years Target date: September, 2006

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	75 000	75 000	75 000	75 000	400 000	5

Tactic 2	Improving Species Knowledge of the Broad Winged Hawk

Status of Knowledge:

A reasonable amount of general life history information is known for the Broad Winged Hawk, but a systematic investigation of regionally relevant life history and association information and distribution has not yet been undertaken.

Activity Summary:

Known occurrences should be targeted as areas around which to begin investigation of associations and identifying occurrences of the Broad Winged Hawk. Once associations are established with some degree of certainty, a plan for moving beyond the known occurrences to seek other occurrences and to verify or amend the association information can be established.

The two main tasks within this knowledge activity are to determine distribution and habitat association to eventually predict habitat suitability and capability through the mapping of occurrences and associations.

Status:

New

Activity Objectives:

To determine what are the regionally specific habitat requirements and what is the status and distribution of the regional population.

Tasks, Deliverables, Targets and Milestones:

Conduct region-wide inventory of occurrences and associations, following consultation with knowledgeable local birders

Create maps from this information, initially of gross habitat associations, looking for patterns of use

Determine appropriate model tool and use this to project habitat suitability/capability.

Timeframe: 3+years

Target date: March 31, 2005

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000			150 000	3

Tactic 3	Improving Species Knowledge of the Northeastern Warblers

Status of Knowledge:

Some general life history information is known for a number of the northeastern warbler species, and for others this knowledge base is limited (see attached knowledge status table); however, a systematic investigation of regionally relevant life history and association information and distribution has not been undertaken

Activity Summary:

A coarse filter reconnaissance inventory, with subsequent mapping, is recommended for the Peace Region.

Status:

New

Activity Objectives:

To evaluate the status of our understanding of habitat requirements for the identified warbler species (Bay-breasted (RED, proposed for Vol. 2, IWMS), Cape May (RED, proposed for Vol. 2, IWMS), Connecticut (RED, proposed for Vol. 2, IWMS), Black-throated green (BLUE, proposed for Vol. 2, IWMS), Canada (BLUE), and Philadelphia Vireo (BLUE)), in the Peace Region, and fill in the knowledge gaps where a need is identified.

To determine the population status and distribution for each identified warbler species in the Peace Region.

Tasks, Deliverables, Targets and Milestones:

Year 1

Review location and results of the few inventories/ studies which have been conducted in this region to-date

Identify areas with appropriate habitat which need to be inventoried to determine the population status and distribution for each identified warbler in the Peace region

**(See below) Conduct breeding bird surveys in areas identified without known inventories, as well as annually replicated surveys in a small subset of known warbler habitats, to establish annual variations. All species of birds heard or seen during the breeding bird surveys, with a focus on the identified warbler ssp., should also be recorded. This will provide more detailed information on the avifaunal community in the Peace Region, as this information is not complete.

Habitat information (vegetation inventory plots at centres of point counts, and at actual locations of birds) should also be collected for each inventory area based on where the identified warbler ssp. are observed to confirm habitat use

When considering breeding bird surveys and how to inventory the Peace region, it would be preferable to conduct surveys over at least 5 years to take into account normal annual variation in bird populations. Their populations are strongly affected by annual weather events and food supply The maximum number of survey years possible allows the better identification of any population trends. This also includes going back to the same inventory areas more than once in a breeding season and, if possible, over more than one breeding season.

The logistics of carrying out breeding bird surveys in the Peace Region are difficult given the size of the region and lack of access to many areas. Expenses will rise if helicopter access is required. Careful consideration will have to be given to the most efficient way of providing thorough, coarse scale inventory information.

Analyse and map data

Year 2

Continue with breeding bird surveys and habitat use

Analyse and map data

Year 3

Continue with breeding bird surveys and habitat use

Analyse and map data

Year 4

Continue with breeding bird surveys and habitat use

Analyse and map data

Year 5

Continue with breeding bird surveys and habitat use

Analyse and map data

Determine if identified warblers are as rare and endangered as originally thought based on population and distribution data collected over last 5 years and make management plans accordingly.

Year 6-8

Based on the population and distribution data collected and, if the identified warblers continue to be considered rare and endangered, then the next step would be to determine breeding success of these warbler ssp. and how they are affected by forestry activity and other human disturbance. A research study of this nature could be initiated at Year 6 and continued for approximately 3 years (to the end of Year 8).

Cost Sharing:

Cost sharing and in-kind contributions would be over and above the estimated investment required. Opportunities for cost sharing and in-kind contributions would have to be explored in tandem with partnerships.

Partnerships:

Partnerships with industry such as forestry and oil and gas companies should be explored as well as possible partnerships with academic institutions such as UNBC.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000	50 000	50 000	150 000+	5-8

Strategy 2: Knowledge of High Sensitivity/Imperfectly Known Species-at-Risk

Tactic 1	Improving Knowledge of Arctic Grayling

Status of Knowledge:

The Arctic Grayling is red-listed provincially, and is proposed for inclusion in Vol. 2. IWMS.

Tactical Summary:

Extrapolating from gathered from Peace-Williston work and other sources, evaluate the status of populations and quantify long term populations trends (declining, maintaining or increasing), determine the distribution across the region with specific attention to watersheds that drain into the Williston reservoir (say why) and establish what are the management implications of unique life history patterns in identified watersheds.

Status:

This is a combination of existing work and new tasks organised systematically under a single, new knowledge tactic.

Tactical Objectives:

Determine the status of the existing knowledge by reviewing existing 1:20 K reconnaissance inventory work; map to determine outstanding data gaps

Perform overview assessments and inventory range-wide, that focus exclusively on Arctic Grayling (explore opportunities and risks to combining with a similar information initiative for Bull trout)

Develop habitat maps and identify watersheds containing the highest/lowest quality of habitat for arctic grayling (and bull trout)

Identify important spawning, rearing, and aggregating areas for grayling (and bull trout) in high quality habitat.

Expand upon Table, Anzac and other Williston watershed life history studies

Based upon a network of suitable index sites, conduct population monitoring over a long-term timeframe

Tasks, Deliverables, Targets and Milestones (Tactical):

This tactical plan incorporates 4, integrated projects. Specific tasks, project objectives and timeframes are presented for each project.

Project 1	Arctic Grayling Knowledge Gap Analysis

Project Status:

New

Project Objectives:

Determine the status of the existing knowledge of the Arctic Grayling by reviewing existing 1:20 K reconnaissance inventory work, and conduct a knowledge gap analysis.

Project Tasks, Deliverables, Targets and Milestones:

Undertake a 1:20 review and compile existing grayling records in a tabular format consistent with Ministry standards. Analyse for knowledge gaps.

Develop maps

Prepare a written summary of current knowledge gaps with recommendations for additional sampling.

Targets: Complete a full review of grayling distribution and gap analysis.

Milestones: Initial draft completed spring 2002, final spring 2003

Cost Sharing:

Partnerships:

Some opportunities may exist to partner with Peace/Williston

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000					50 000	1

Project 2	Arctic Grayling Inventory and Habitat Mapping

Project Status:

New

Project Objectives:

Perform overview assessments and inventory range-wide, that focus exclusively on Arctic Grayling (explore opportunities and risks to combining with a similar information initiative for Bull trout)

Develop habitat maps and identify watersheds containing the highest/lowest quality of habitat for arctic grayling (and bull trout)

Project Tasks, Deliverables, Targets and Milestones:

Complete a full grayling inventory in the Mackenzie Forest District over a 5-year time frame, using the gap analysis (Project 1) to guide planning.

Provide an analysis of the suitability of each watershed surveyed to sustain viable grayling populations., concurrent with the grayling inventory (above),

Targets: 1 to 2 major (6th order or higher) watersheds per year, 2002-2007

Milestones: yearly reports compiled in a data series.

Cost Sharing:

Partnerships:

Some opportunities may exist to partner with Peace/Williston

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	100 000	100 000	100 000	500 000	5

Project 3	Arctic Grayling Critical Habitat Mapping

Project Status:

New

Project Objectives:

Identify important spawning, rearing, and aggregating areas for grayling (and bull trout) in high quality habitat (identified in Project 2)

Project Tasks, Deliverables, Targets and Milestones:

Where viable populations are identified in the Mackenzie FD, direct intensive efforts to quantify habitat use at spawning and rearing areas. If spawning activity is suspected, conduct telemetry or conventional tagging studies to further delineate spawning and rearing areas. Conduct systematic snorkel surveys to identify aggregating areas where conditions permit.

Targets: 1 to 2 major (6th order or higher) watersheds per year if grayling populations are identified from inventory work.

Milestones: 2003-2006. develop maps of spawning, rearing, and aggregating areas and provide recommendations on habitat protection measures for these sites.

Costs: $75,000 per watershed, where viable populations are found.

Cost Sharing:

Partnerships:

Partner with Peace/Williston

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		150 000	150 000	150 000	150 000	150 000	750 000	5

Project 4	Arctic Grayling Life History Research and Population Monitoring

Project Status:

This project is a expansion of life history studies underway.

Project Objectives:

Expand upon Table, Anzac and other Williston watershed life history studies.

Undertake long-term population monitoring based on indexed population sites.

Project Tasks, Deliverables, Targets and Milestones:

Where life history traits (growth, condition, feeding strategies, seasonal habitat use, and run timing) appear to be geographically differentiated, perform detailed research that examines differences in these traits, and then develop local population-specific management plans.

Using standardised index methods, conduct population surveys at 3-year intervals at index sites developed from the range-wide inventories (Project 2).

Targets: Describe life history differentiation where it exists and develop population-specific life history species accounts. Index a minimum of 5 populations throughout the Mackenzie FD at 3-year intervals. Initial index surveys 2002-2007.

Milestones: Index 1 to 2 populations per year.

Costs: $20,000 per index site. Population studies $50,000 per population.

Cost Sharing:

Partnerships:

Partner with Peace/Williston

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	100 000	100 000	100 000	500 000	5

Tactic 2	Improving Knowledge of Bull Trout

State of Knowledge:

Bull Trout are blue listed and identified wildlife. These vulnerable species have characteristics that make their populations especially sensitive to human activities or natural disturbances.

Geographical sensitivities to harvesting and angling are pronounced in the Robson Valley and Mackenzie (Williston), followed by Prince George.

Tactical Summary:

An underlying management objective for bull trout is to conserve the abundance and diversity of naturally occurring populations, and to maintain/enhance habitat

Building upon existing information gathered from studies performed around the region and elsewhere,, this tactic will:

quantify long term population trends (declining, maintaining or increasing),

determine the regional population distribution and the management implications of unique life history patterns in identified watersheds.

**Note: Many of the objectives and activities associated with bull trout in this section could be equally applied to blue-listed Dolly Varden (Salvelinus malma) and Inconnu (Stenodus leucichthys)

Status:

This is a combination of existing work and new tasks organised systematically under a single, new knowledge tactic.

Tactical Objectives:

The overall tactical objective is to improve knowledge of the distribution and habitat needs of Bull Trout and the interactions with forestry activities to inform management so that future degradation of habitat and reduction in abundance and health of Bull Trout populations can be avoided or mitigated.

Tasks, Deliverables, Targets and Milestones (Tactical):

This tactical plan consists of 6, integrated projects. Specific tasks, project objectives and timeframes are presented for each project.

Project 1	Bull Trout Knowledge Gap Analysis

Project Status:

New

Project Objectives:

Determine the status of the existing knowledge by reviewing existing 1:20 K reconnaissance inventory work;

Map to determine data gaps.

Project Tasks, Deliverables, Targets and Milestones:

Undertake the 1:20 review by hiring a qualified contractor to review and compile existing bull trout records in a tabular format, consistent with Ministry standards. Develop maps internally using Ministry GIS resources. Submit recommendations for additional sampling to fill knowledge gaps.

Targets: Complete a full review of bull trout distribution in the Prince George, Mackenzie, Ft. St. James and Vanderhoof forest districts.

Milestones: initial draft completed spring 2002, final fall 2002.

Costs: $50,000 per district, cost shared with grayling review for Mackenzie.

Cost Sharing:

Partnerships:

Some opportunities may exist to partner with Peace/Williston for work in the Mackenzie Forest District.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		200 000					200 000	1

Project 2	Bull Trout Inventory and Habitat Mapping

Project Status:

New

Project Objectives:

Conduct further fish habitat inventory focusing on bull trout (and grayling) to identify their habitat and distribution

Develop habitat maps and identify watersheds containing the highest/lowest quality of habitat for bull trout (and arctic grayling)

Project Tasks, Deliverables, Targets and Milestones:

Complete bull trout inventories in the Mackenzie, Prince George, Vanderhoof and Ft. St. James forest districts over a 5 year time frame, using the gap analysis (Project 1) to guide planning.

Targets: Undertake concurrent inventories in each forest district over five years, 2002-2007.

Milestones: yearly reports compiled in a data series.

Costs: $75,000/year x 5 yr. x 4 forest districts = $1,500,000.

Cost Sharing:

Partnerships:

Some opportunities may exist to partner with Peace/Williston in the Mackenzie Forest District.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		300 000	300 000	300 000	300 000	300 000	1 500 000	5

Project 3	Bull Trout Critical Habitat Mapping

Project Status:

New

Project Objectives:

Identify important spawning, rearing, and aggregating areas for bull trout (and Arctic Grayling) in high quality habitat (identified in Project 2)

Project Tasks, Deliverables, Targets and Milestones:

Where viable populations are identified, direct intensive efforts to quantify habitat use at spawning and rearing areas. If spawning activity is suspected, conduct telemetry or conventional tagging studies to further delineate spawning and rearing areas. Conduct systematic snorkel surveys to identify aggregating areas where conditions permit.

Targets: 1 to 2 major (6th order or higher) watersheds per year if bull trout populations are identified from 1:20K inventories.

Milestones: 2003-2008: develop maps of spawning, rearing, and aggregating areas and provide recommendations on habitat protection measures for these sites.

Costs: $75,000 per watershed, where viable populations are found.

Cost Sharing:

Partnerships:

Partner with Peace/Williston

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		300 000	300 000	300 000	300 000	300 000	1 500 000	5

Project 4	Bull Trout Habitat Prediction Model Development

Project Status:

New

Project Objectives:

Using existing population and habitat information, develop and apply models to predict Bull trout habitat preferences and use (habitat suitability)

Project Tasks, Deliverables, Targets and Milestones:

Using data obtained from detailed habitat use studies, and in conjunction with research agencies and other regions, develop a modelling working group to build habitat suitability and distribution models for northern populations of bull trout. Apply these models in land use decision processes.

Targets: Develop a working model by 2005.

Milestones: 2003-2008. Form modelling group in 2003, build model by 2005, and apply in 2006-2008.

Costs: $30,000 per year.

Cost Sharing:

Partnerships:

Collaborate with UNBC, other WLAP and MSRM regions and HQ.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			30 000	30 000	30 000	30 000	120 000	4

Project 5	Bull Trout Population Monitoring

Project Status:

New

Project Objectives:

Based upon a network of suitable index sites, conduct spawning population monitoring over a long-term timeframe

Project Tasks, Deliverables, Targets and Milestones:

Using standardised index methods, conduct population surveys at 3-year intervals at index sites developed from the range-wide inventories. Use redd mapping methods where feasible and appropriate to describe spawning recruitment rates over time.

Targets: Index a minimum of 3 populations per forest district at 3-year intervals. Initial index surveys 2002-2007.

Milestones: Index 1 population per year per forest district.

Costs: $20,000 per index site.

Cost Sharing:

Partnerships:

Partner with Peace/Williston

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		80 000	80 000	80 000	80 000	80 000	400 000	5

Project 6	Bull Trout/Forest Development Interaction Research

Project Status:

New

Project Objectives:

Evaluate interactions between forest development and Bull trout.

Project Tasks, Deliverables, Targets and Milestones:

Where significant populations are found within active forestry operating areas, conduct research to assess the long-term impacts of such activity to viable bull trout populations. Using a combination of population index data and applied research methods, evaluate how changes to temperature regimes and hydrological stability affect bull trout population structure. Recommend changes to harvest strategies to accommodate bull trout life history requirements.

Targets: Compare logged and unlogged watersheds, 1 set per forest district, 2002-2007.

Milestones: Build research platform 2002, apply 2003-2005. Report or thesis completion 2006.

Cost Sharing:

Partnerships:

Partner with UNBC. Cost-share with PWFWCP.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	100 000	100 000	100 000	400 000	5

Strategy 3: Knowledge of Moderate Sensitivity/Imperfectly Known Species-at-Risk

Tactic 1	Improving Species Knowledge: White Sturgeon

Knowledge Status:

A reasonable amount of population and habitat information exists for the Nechako-Fraser mainstems, which currently supports management decision-making. Significant population and habitat knowledge gaps exist for the Stuart-Takla, and larger Fraser tributary systems (Bowron, Torpy, Mcgregor, Goat River).

Tactical Summary:

An underlying management objective for White Sturgeon is to conserve the abundance and diversity of naturally occurring populations and to maintain/enhance habitat

Detailed stock and habitat use studies are needed for the Stuart-Takla system and the major Fraser tributaries. Activities that quantify long-term population trends (declining, stable or increasing) and establish if there are unique life history requirements in specific portions of systems should be undertaken. Where unique requirements are identified, specific management approaches may need to be explored and employed.

Status:

This is a combination of existing work and new tasks organised systematically under a single, new knowledge tactic.

Tactical Objectives:

The objective of this tactic is to improve our understanding of the distribution and habitat needs of this species and the interactions with forestry activities to inform management so that future degradation of habitat and reduction in abundance and health of White Sturgeon populations can be avoided or mitigated.

Tasks, Deliverables, Targets and Milestones (Tactical):

This tactical plan consists of 4integrated projects. Specific tasks, project objectives and timeframes are presented for each project.

Project 1	White Sturgeon Population Distribution and Habitat Use

Project Status:

New

Project Objectives:

Undertake systematic distribution studies in the Stuart-Takla drainage.

Assess habitat use by different life history stages at preferred habitat sites in the Stuart-Takla and Upper Fraser.

Project Tasks, Deliverables, Targets and Milestones:

Implement a five-year targeted sampling program to define the distribution and population status of sturgeon in the Stuart and Takla watersheds. Prepare and deliver annual reports as milestones are reached.

Targets: Describe the distribution and population status of sturgeon in the Stuart River, Stuart Lake, Tachie River, Trembleur Lake, Middle River, and Takla Lake.

Milestones: Complete sampling according to the following schedule: 2002/3 Stuart River, 2004 Stuart Lake/Tachie River, 2005 Trembleur Lake/Middle River, 2006 Takla Lake.

Costs: $180,000 per year.

Cost Sharing:

Partnerships:

Partner and cost share with the Habitat Conservation Trust Fund

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		180 000	180 000	180 000	180 000	180 000	900 000	5

Project 2	White Sturgeon Population Limits Study

Project Status:

New

Project Objectives:

Confirm upstream limits of distribution in the Fraser main tributaries

Project Tasks, Deliverables, Targets and Milestones:

Implement a three-year targeted sampling program to describe upstream limits of distribution and habitat utilisation in the McGregor, Torpy, Bowron, and Goat rivers. Assess the linkage between sturgeon found in these systems and mainstem Fraser River population.

Targets: Describe the distribution of sturgeon in the McGregor, Torpy, Bowron, and Goat watersheds.

Milestones: Complete sampling according to the following schedule: 2002 Goat, 2003 Bowron, 2004 Torpy, 2005 McGregor

Cost Sharing:

Partnerships:

Partner and cost share with the Lheidl'i T'Enneh band and the Nechako River Sturgeon Recovery Team.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000	50 000		200 000	4

Project 3	White Sturgeon/Nechako Population Study

Project Status:

New

Project Objectives:

Determine causes for the collapsing Nechako system population – i.e. Bottlenecks to population recruitment, or other causes.

Project Tasks, Deliverables, Targets and Milestones:

Taking direction from the Nechako Sturgeon Recovery Team, undertake an evaluative and experimental recovery process using various experimental approaches.

Targets: Establish a viable, self-sustaining population of sturgeon in the Nechako River.

Milestones: Apply experimental design over a five-year time frame, 2002-2007.

Cost Sharing:

Partnerships:

Partner and cost share with Nechako Sturgeon Recovery Team

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		200 000	200 000	200 000	200 000	200 000	1 000 000	5

Project 4	White Sturgeon/Forest Development Interactions

Project Status:

New

Project Objectives:

Evaluate interactions between forest development and Sturgeon

Project Tasks, Deliverables, Targets and Milestones:

Compare the status of populations residing in pristine tributaries to the mainstem Fraser River (see above) to those residing in the Bowron River. Compare historical pre-harvest habitat features in logged systems to identify loss of structural integrity at the reach level, and hydrological features at the watershed level, that are attributable to logging. Undertake an evaluation of sturgeon habitat use in pristine waters to identify habitat features requiring protection.

Targets: Identification of critical habitat features at both reach and watershed scales that may be impacted by forestry operations.

Milestones: Complete analysis by 2005.

Cost Sharing:

Partnerships:

Partner and cost share with Nechako Sturgeon Recovery Team, Lheidl'i T'Enneh Band.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000			150 000	3

Tactic 2	Improving Species Knowledge: Wolverine

Knowledge Status:

Wolverines are wide-ranging forest carnivores that are on the Provincial Blue List, meaning that this species is vulnerable. They require large tracts of habitat, have low reproductive rates, poor juvenile survival, exist in relatively low densities, and are sensitive to over-trapping, which contributes to their vulnerability. They appear to do best in relatively undisturbed remote mountain areas in habitats as diverse as old-growth forest and tundra.

Little inventory data, with the exception of a 5-year investigation in the Mackenzie Forest District, is available for wolverine in BC.

Forest development activities and other human activities in remote areas, which influence prey populations, disturb denning areas, and improve access for trapping may indirectly place considerable pressure on wolverine populations. Decreases in landscape connectivity, increase in road density and associated increase in human use of remote backcountry areas, and disturbance factors in mid and upper elevation forests pose threats to wolverine. Availability of a diverse prey base in an ecosystem with a full tropic web is a critical requirement for wolverine. Thus, maintenance of other wildlife populations like caribou, moose, goat, wolf, snowshoe hare, hoary marmot, and ground squirrels is critical.

Wolverines have very diverse and difficult to define habitat requirements. This is because wolverines use habitats where their prey are most abundant to hunt; other kinds of habitats in are used as travel corridors. They do not often directly select for the habitat itself, but through the habitat of prey species. The only exception is choice of natal denning areas, and summer rearing areas for young. Consequently habitat suitability mapping and habitat supply modelling is likely to be inaccurate and of limited value for wolverines, except for mapping of natal denning and rearing habitat suitability.

The Northern Wolverine Project was initiated in 1996 to 2001 by the Ministry of Environment, Lands and Parks, which documented the distribution and abundance of wolverine in plateau and foothill landscapes. During this project, 40 different individuals were live trapped and instrumented with radio-transmitters. Basic ecological knowledge such as home range information and habitat use was documented. Sources of moralities were monitored and included trapping, con-specific mortality, predation, highway collisions, and natural causes. Maternal dens were located in high elevation forest, sub alpine cirques, and talus slopes.

Tactical Summary:

In order to improve consideration of wolverine in forest management decisions, baseline information on movement, home range, habitat use, food habitat, and population information must be collected across the Omineca-Peace Region and used to develop habitat assessments and adaptive management models. This is a priority activity for the Dawson Creek Forest District.

Information gained from this effort should be expanded in other forest districts, and inventory data should be used to refine wildlife habitat assessments and to develop an adaptive management model.

Although the field portion of the Mackenzie Northern Wolverine project is finished, final reporting and analysis are not yet complete. Since the information from this study is most applicable to the region, it should be the first order of business to extract the relevant information from the project and translate these into planning language and guidelines. Of special interest from a forest development point of view are:

Den sites and associated measures for protection/management;

Habitat selection at stand and landscape scale;

Connectivity requirements (are they covered off under riparian Management?);

Roads – density and traffic (direct mortality and access for trappers);

Winter range management for ungulates (if prey/carrion-producing habitats are not maintained then wolverine might be negatively affected).

Similar inventories should be conducted beyond the Mackenzie Forest District to examine population dynamics, and habitat use and movement patterns that evaluate interactions between forest development and Wolverine and enable the development of habitat management guidelines for these species that will likely require actions on a regional, landscape, and stand level scales.

Tactical Objectives:

Develop habitat suitability layers for (a) natal denning, and (b) summer rearing of young-of-the-year (survival of young to independence is one of the most sensitive parameters to population viability). The den habitat model should focus on den security and account for movement of denning females.

Put more emphasis on habitat supply modelling for key forest-dwelling wolverine prey and sources of food from scavenging, so that spatial and temporal patterns of forest harvesting can do a better job of maintaining healthy populations of those species. The key species are: caribou, snowshoe hare, and moose)

Develop habitat management guidelines for these species that will likely require actions on regional, and landscape levels.

Conduct population monitoring.

Tasks, Deliverables, Targets and Milestones (Tactical):

This tactical plan consists of 7integrated projects. Specific tasks, project objectives and timeframes are presented for each project.

Project 1	Northern Wolverine Project Reporting

Project Status:

New, but based on research completed to date.

Project Objectives:

Facilitate complete data analysis and reporting from the Northern Wolverine Project.

Project Tasks, Deliverables, Targets and Milestones:

Project debriefs, data assembly, analysis and report preparation.

Timeframe: 4-5 months

Target date: July, 2002

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		25 000						1

Project 2	Wolverine Critical Habitat Prediction Model Development

Project Status:

New

Project Objectives:

Develop Wolverine natal denning and summer rearing habitat prediction model capable of projecting habitat suitability layers (digital maps).

Project Tasks, Deliverables, Targets and Milestones:

Based on the following sources:

- literature review
- new knowledge from the Northern Wolverine Project regarding summer feeding habits
- a hoary marmot suitability mapping exercise for alpine areas (built on data from the Mackenzie study and work and
- existing habitat suitability layers for other terrestrial sciurids (principally Columbian ground squirrel) in the Rockies). These would be at 1:250,000, using BEU mapping
- Kootenay wolverine project

Develop and calibrate a Wolverine Denning Habitat Prediction Model, and an associated "no disturbance buffer" algorithm;

Validate the accuracy of model predictions of Wolverine natal and rearing areas in representative mountain landscapes through aerial and ground confirmation (including prey species mapping)

Costs: $110,000 for model development ($60,000 in first year and $50,000 in second year); $80,000 for model validation ($50,000 in the second year and $30,000 in the third year).

Timeframe: 3 years

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		60 000	100 000	30 000			190 000	3

Project 3	Wolverine Critical Habitat Decision Support

Project Status:

New

Project Objectives:

Integrate critical habitat suitability mapping (Project 2) technology into district access management plans, habitat disturbance guidelines (to BCAL, and the forest industry) regarding backcountry recreation and industrial road closures (timing and techniques).

Project Tasks, Deliverables, Targets and Milestones:

Production, interpretation and use of habitat suitability layers for (a) natal denning, and (b) summer rearing of young.

Development of habitat disturbance guidelines

Cost: $100,000

Timeframe: 2-3 years following completion of Project 2.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
					50 000	50 000	100 000	2

Project 4	Wolverine Habitat Supply Model Development

Project Status:

New

Project Objectives:

Develop a suitable Wolverine food-habitat supply projection model. This model must project the potential availability of key Wolverine prey and scavenged food sources (including caribou, snowshoe hare, and moose). This will facilitate a better understanding of the impacts of spatial and temporal patterns of forest harvesting on Wolverine habitat.

Project Tasks, Deliverables, Targets and Milestones:

Uncertain; will depend on whether there is a Habitat Supply modelling framework in place for the Region (e.g., SELES). Considerable investment is required in getting some agreement on habitat supply modelling approaches, then on building spatially explicit models for certain species.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
					200 000	300 000		2+

Project 5	Wolverine Synecology Research

Project Status:

New

Project Objectives:

Examine relationship between foraging habitats and presence of hoary marmots (partially completed in Northern Wolverine Project).

Project Tasks, Deliverables, Targets and Milestones:

Potential Investment: $75,000

Potential Timeframe: 2 years

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		35 000	40 000					2

Project 6	Wolverine Management Decision Support

Project Status:

New

Project Objectives:

Develop regional and landscape level guidelines for Wolverine management.

Project Tasks, Deliverables, Targets and Milestones:

Potential Timeframe: 1 year following Project 1; and during second year of Project 3

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			50 000		50 000			2

Project 7	Wolverine Population Monitoring Pilot Study

Project Status:

New

Project Objectives:

Establish and complete a DNA-based inventory of 2 or more 10,000-50,000 km2 units. Census should be conducted pre-forest development and 5-10 years following forest-development.

Employ hair capture techniques to derive a mark-recapture estimate of population size. At least 1 site should be considered a "control" where forest development is absent or minor in nature. Repeat the census in 5-10 years and compare estimates.

Project Tasks, Deliverables, Targets and Milestones:

Timeframe: 2002 & 2007

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000				50 000		5+

Tactic 3	Improving Species Knowledge: Grizzly Bear

Status of Knowledge:

Grizzly bears are provincially Blue Listed Vol. 1 IWMS species, and are a species of special concern at the national level (COSEWIC species of Special Concern). In order to adequately manage and conserve grizzly bears, information on population characteristics and habitat requirements is needed. There is currently little information upon which to base grizzly bear management decisions and there is little population or habitat inventory for grizzly bears in the Central Interior of BC, where the most intensive resource extraction activity is timber harvesting.

Tactical Summary:

The underlying objective of this knowledge tactic is to enable the identification and conservation of grizzly bear habitat to assist in sustaining viable populations. This requires accurate population and habitat inventory data to support management decisions that lead to sustaining grizzly habitat and populations.

A number of investigations are recommended which will provide improved estimates of:

population density;

reproductive and mortality rates,;

seasonal habitat-use patterns and critical habitat types;

seasonal movements;

home ranges; and

food habits.

This data and knowledge should then be incorporated into the development of suitable habitat prediction models.

Current work on Grizzly Bear Population and Habitat Inventory in the Parsnip River Drainage in the Prince George Forest District should continue and be applied elsewhere in the region.

Status:

New. There is currently little information upon which to base grizzly bear management decisions and there is little population or habitat inventory for grizzly bears in the Central Interior of BC, where the most intensive resource extraction activity is timber harvesting.

Tactical Objectives:

To enable the identification and conservation of grizzly bear habitat to assist in sustaining viable populations.

Tasks, Deliverables, Targets and Milestones (Tactical):

The following tasks are not placed in the order that they should be undertaken or completed – this list represents a grouping of tasks that are largely interrelated:

Continue to invest in the completion of work on Grizzly Bear Population and Habitat Inventory in the Parsnip River Drainage in the Prince George Forest District and apply the findings elsewhere in the region where appropriate.

Across the region, identify, survey, and map grizzly bear distribution and habitat, paying particular attention to high use early spring habitats.

Because of the vulnerability of grizzly bears to habitat changes, continue to collect data on grizzly bear habitat use as a basis for formulating a grizzly bear habitat management strategy, and for determination of hunting management options.

Investigate differences in life history/habitat use patterns between ecological/physiographic associations.

Conduct grizzly bear census and population estimates

Determine grizzly bear movements, habitat use, density, through radio-collaring and telemetry work

Investigate the factors affecting grizzly bear movements

Investigate grizzly bear density in relation to moose densities

Conduct and replicate DNA studies throughout region

Develop a GIS-based habitat evaluation tool for grizzly bears and resource selection function models and Wildlife Habitat Area suitability mapping

Continue to analyse data and develop habitat management recommendations from past and current grizzly inventories and projects. Provide guidelines and standard operating procedures in grizzly bear habitat to forest licensees and other industrial users.

Investigate the value of applying alternative silviculture to prime valley bottom habitat where the availability of forage is an issue. For example, we could modify stocking standards to ensure valley bottom second growth stands are not so dense as to exclude the growth of forage species. This would likely form the basis of a long-term research project.

Collect additional information on grizzly bear habitat selection to optimise selection of WHA's, and to establish appropriate objectives for age class, patch size, connectivity, and access management that will achieve the conservation of grizzly bear habitat within managed landscapes.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		150 000	150 000	150 000	100 000	100 000	650 000	5

Tactic 4	Improving Species Knowledge: Fishers

Status of Knowledge:

Fisher is an Identified Wildlife species, and as well Blue Listed (vulnerable). They are considered to be habitat specialists, fulfilling all their life requirements in forested habitats. Because they are also associated with late-successional forests, forest-harvesting activities can have a detrimental effect on fisher populations by altering and degrading the abundance and distribution of required resources and habitat features. Fisher populations occur at low densities and are sensitive to fur harvesting activities.

The Peace/Williston Fish & Wildlife Compensation Program (PWFWCP) (Weir, 2000) conducted a 5-year inventory project (1996-2000) examining the ecology of fishers in sub-boreal landscapes of the Williston Reservoir watershed within the Mackenzie Forest District. The broad objectives of the study were to document home ranges, movements, and habitat selectivity of fishers. In this geographic area, fishers were found to have larger home ranges than reported elsewhere in North America. It is unclear as to why, but it is hypothesised that the resources they need may be distributed more sparsely thereby causing fishers to cover larger areas to sequester needed resources. Fishers were found to preferentially use coarse woody debris sites when colder ambient temperatures occurred, suggesting that large pieces of CWD may be important habitat features in northern climes. Natal and maternal den sites were investigated and female fishers were found to den exclusively in large-diameter declining Populus balsamifera trees.

The inventory efforts of this project should be applied to other forest districts in the region. Specific recommendations are for:

Continued effort should be directed toward assessing survivorship rates from radio telemetry data to help determine the vulnerability of fisher populations.

Further investigation on female fisher home ranges is needed to establish the relationship between habitat quality and home range size.

Preferred denning sites were found to be in the cavities of black-cottonwood trees and future work needs to determine the preferred characteristics, and frequency with which these features occur and the effects of the distribution of these elements on female fishers.

Continue to gather inventory information that will aid in the development of habitat management and conservation of old forest structures that may be a limiting factor for fisher distribution.

Future effort should be directed towards continuing to assess re-use of natal dens and determine if the availability of suitable denning sites is limited across the landscape.

Complete GIS analysis on habitat data.

Tactical Summary:

The underlying objective for filling fisher management related knowledge gaps is to collect information and develop guidelines and tools to facilitate the management and conservation of fishers and their habitat in the forested landscapes of the Omineca-Peace Region. This is a priority activity for the Dawson Creek Forest District.

Status:

New – but includes extension of the Peace/Williston Fish & Wildlife Compensation Program study.

Tactical Objectives:

To collect information and develop guidelines and tools to facilitate the management and conservation of fishers and their habitat in the forested landscapes of the Omineca-Peace Region.

Tasks, Deliverables, Targets and Milestones (Tactical):

This tactical plan consists of 7 integrated projects. Specific tasks, project objectives and timeframes are presented for each project.

Project 1	Fisher/Forest Development Interactions

Project Status:

New.

Project Objectives:

Evaluate interactions between forest development and fishers.

Project Tasks, Deliverables, Targets and Milestones:

Evaluate interactions between forest development and fishers. This is a very broadly stated activity, which likely requires a series of projects to be developed in order to investigate their interactions and identify the potential negative impacts of forestry development on fishers. Concurrent and/or subsequent development, testing, and refinement of predictive models/management tools could also then be implemented in an attempt to reduce, mitigate, or alleviate those activities and situations that were detrimental to fishers.

Timeframe: 2002

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		40 000					40 000	1

Project 2	Fisher Population Research

Project Status:

New

Project Objectives:

Determine vulnerability of fisher populations

Project Tasks, Deliverables, Targets and Milestones:

Determine the vulnerability of fisher populations. A population's vulnerability is dependent, in part, on the survivorship of its individuals and their ability to adjust (e.g., emigration and re-establishment) to negative pressures or to exploit new areas (e.g., juvenile dispersal). The ability to successfully access proximal habitats on a landscape that is increasingly partitioned is difficult. Conduct further and more intensive monitoring activities in order to assess fisher survivorship rates and dispersal/emigration success in managed landscapes, where forest and/or fur harvesting occur, and specifically

Determine dispersal/emigration requirements and hindrances (impediments?); and

Investigate fisher survival and reproductive parameters using radio-telemetry monitoring.

Timeframe: 4 years

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		80 000	80 000	80 000	80 000		320 000	4

Project 3	Fisher Critical Habitat Research

Project Status:

New.

Project Objectives:

Better characterise the attributes and availability of fisher natal den sites.

Project Tasks, Deliverables, Targets and Milestones:

Better characterise the attributes and availability of fisher natal den sites. Conduct further work to determine the preferred characteristics and frequency with which denning sites (e.g. cavities in declining Populus balsamifera) occur, and the effect their distribution has on female fishers.

Investigate the availability (abundance and distribution) and suitability of large diameter cottonwoods as natal and maternal dens for fishers, and characterise preferred fisher den sites.

Timeframe: 1-2 years

Target date: 2004

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		35 000	35 000				70 000	2

Project 4	Fisher Habitat Assessment Methodology

Project Status:

New

Project Objectives:

Develop a fisher-based habitat assessment protocol.

Project Tasks, Deliverables, Targets and Milestones:

Develop a fisher-based habitat assessment protocol. Refine or further develop habitat assessment parameters that better characterise habitat attributes deemed important to fishers (e.g., den sites, winter rest sites, travel logs, etc.).

Timeframe: 1-2 years

Target date: 2004

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		10 000	10 000				40 000	2

Project 5	Fisher Management Decision Support Tools - Initial

Project Status:

New

Project Objectives:

Develop habitat management guidelines for fisher.

Project Tasks, Deliverables, Targets and Milestones:

Develop habitat management guidelines for fishers. Separate guidelines will likely be required for the different spatial levels (e.g., patch, and landscape).

This could be accomplished through technical workshop exchanges, and the production of a dynamic document based on the most current information.

Timeframe: 2 years

Target date: 2004

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		15 000	15 000				30 000	2

Project 6	Fisher Management Decision Support Tools - Improved

Project Status:

New

Project Objectives:

Improvement of regional, or ecosystem specific decision support tools for Fisher management.

Project Tasks, Deliverables, Targets and Milestones:

Further examine ecology of fishers in boreal forests due to differences in climatic conditions and forest composition and structure.

Continue to gather inventory information that will aid in the development of regionally specific (or ecosystem-based) forest management decisions and guidelines for fisher.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	100 000	100 000	100 000	500 000	5

Project 7	Fisher Population Monitoring Pilot Study

Project Status:

New

Project Objectives:

Establish and complete a DNA-based inventory of 2 or more 10,000-50,000 km2 units. Census should be conducted pre-forest development and 5-10 years following forest-development.

Employ hair capture techniques to derive a mark-recapture estimate of population size. At least 1 site should be considered a "control" where forest development is absent or minor in nature. Repeat the census in 5-10 years and compare estimates.

Project Tasks, Deliverables, Targets and Milestones:

Timeframe: 2002 & 2007

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000				50 000		5+

Tactic 5	Improving Species Knowledge: Short Eared Owl

Status of Knowledge:

This owl is blue-listed provincially, is a COSEWIC species of Special Concern, and is proposed for inclusion in Vol. 2, IWMS. The short eared owl is faced with loss of its favoured grassland habitats throughout the southern part of the province. This blue-listed species is faced with loss of its favoured grassland habitats throughout the southern part of the province. The extent of its distribution in the north and central parts of the province, and its breeding status therein, remain largely unknown.

Tactical Summary:

The recommended tactic to address knowledge gaps for this species is to determine the extent of its range, and it's preferred habitats, and local life histories. This is considered an ancillary priority within the Dawson Creek Forest District.

Status:

New

Tactical Objectives:

To determine the extent of its range, and it's preferred habitats, and local life histories.

Tasks, Deliverables, Targets and Milestones (Tactical):

Establish the status of the population by conducting a coarse filter reconnaissance inventory and assessment of habitat use throughout the region, based on an analysis of potential suitable habitat, a literature review, and interviews with knowledgeable birders.

Map distribution and occurrences over time

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000				100 000	2

Tactic 6	Improving Species Knowledge: Greater Sandhill Crane

Status of Knowledge:

The sandhill crane is blue-listed provincially, and is currently on the Identified Wildlife Volume 1 list. Wildlife Habitat Areas are prescribed for cranes on wetlands less than 5 ha. in size, as presumably the riparian protection provisions of the Forest Practices Code are felt to offer enough protection for nesting birds on the predominantly much larger nesting habitats they frequent. Though primarily a species of large, wet meadows and open grasslands, it often makes use of timbered habitats surrounding its nest areas as cover and feeding habitat. Its population would appear to be dispersed throughout the Central Interior, breeding in the innumerable sedge meadow/fen/marsh combinations that occur throughout the plateau. Numerous anecdotal reports of cranes nesting throughout the region are on file, but no systematic surveys have ever been done to determine the extent of their range, or their precise habitat needs.

Tactical Summary:

The recommended knowledge tactic to address knowledge gaps for this species is to determine its range, it's preferred habitats, and local life histories.

Status:

New

Tactical Objectives:

To determine its range, it's preferred habitats, and local life histories.

Tasks, Deliverables, Targets and Milestones (Tactical):

Establish the status of the population – perform coarse filter reconnaissance inventory region-wide and assess habitat use throughout the region, based on an analysis of potential suitable habitat, a literature search, and interviews with knowledgeable birders, landowners, and foresters

Map distribution and occurrences over time

Cost Sharing:

Partnerships:

Investment to date		Investment Required						
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000				100 000	2

Tactic 7	Improving Species Knowledge: Great Blue Heron

Status of Knowledge:

This subspecies is blue-listed in B.C. Its nest is specifically protected under Section 34 of the Wildlife Act, and its active nests are a designated "resource feature" under the Forest Practices Code. The great blue heron is a somewhat uncommon bird of the interior; the centre of the species' abundance is on the B.C. coast. However, they can be seen with some regularity in the Prince George and Robson Valley Forest Districts, and isolated nesting has been noted in the latter district. It is likely that riparian protection provisions will accommodate any nests discovered, but no systematic surveys have been undertaken.

Tactical Summary:

The recommended tactic to address knowledge gaps for this species is to

Status:

New

Tactical Objectives:

To determine the extent of its range, and it's preferred habitats, and local life histories.

Tasks, Deliverables, Targets and Milestones (Tactical):

Establish the status of the population – perform coarse filter reconnaissance inventory region-wide and assess habitat use throughout the region, based on an analysis of potential suitable habitat, a literature search, and interviews with knowledgeable birders, landowners, and foresters

Map distribution and occurrences over time

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000				100 000	2

Strategy 4: Knowledge of Low Sensitivity/Imperfectly Known Species-at-Risk[4]

Tactic 1 Improving Species Knowledge: American Bittern

Status of Knowledge:

This blue-listed species is currently on the Identified Wildlife list (WHAs can be established for wetland nesting areas less than 5 ha. in size. Literature on the species suggests that such small wetlands are the exception rather than the rule for nesting habitat). Likely its greatest threat would come from drainage of the marshes it requires for breeding, or degradation of the quality of the water and aquatic foods it depends on. Forest harvesting is not generally considered to be a threat to bitterns, which are very much a wetland species, making essentially no use of upland habitats.

Tactical Summary:

Our tactical objective with this species would be simply to document its range via systematic surveys, and determine the extent of threats to its persistence.

Status:

New

Tactical Objectives:

To document its range via systematic surveys, and determine the extent of threats to its persistence.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000					50 000	1

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[4] Included in this category are:

The **Plains Bison** (Blue Listed) in the Fort St. John Forest District, and the **Wood Bison** (Red Listed) in the Fort Nelson Forest District. Both are grazers and rangeland species, neither makes use of commercial forests to such an extent that forestry activities could be considered threatening to their populations. No knowledge enhancement tactic is proposed for either of these species.

Five species of fish in the Fort Nelson Forest District (**Cisco; Arctic Cisco; Emerald Shiner; Spottail Shiner; and Ninespine Stickleback**). These species are red-listed in this forest district, but are not felt at present to be priorities for research or conservation. No knowledge enhancement tactic is recommended for any of these.

Prairie Falcon - Red-listed provincially, and currently an IWMS species, prairie falcons MAY nest in isolated locations in the Robson Valley FD. As a cliff-nesting species, they are likely to be only marginally affected by forestry activities. Nest searches for these falcons would be costly and time-consuming, and involve investigation of a great deal of very rugged terrain.

Tactic 2	Improving Species Knowledge: Bobolink

Status of Knowledge:

Blue-listed and currently on the Identified Wildlife list, the bobolink is an ephemeral resident of the Prince George region, recorded ONLY from hay fields in the Giscome area, near Prince George. Some years, it would appear to be absent altogether from our region. This is a bird right on the edge of its range, which is essentially a large belt across the middle of Canada (east of the Rockies and including portions of southern B.C.) and the U.S. to the Atlantic coast. Preferred habitats include native long-grass prairie, hayfields and other cultivated grasslands. Forestry activities other than range use are not a concern with bobolinks, whose major threats are loss of native grassland habitats and changing agricultural practices (moving away from cropping hay only once, late in the season, to more intensive haying, for example).

Tactical Summary:

Extension activities are recommended to inform landowners of practices suitable for the maintenance of bobolink populations, would likely be the most effective conservation measure we could apply.

Status:

New

Tactical Objectives:

Increase the use of existing information and knowledge through a program of extension.

Tasks, Deliverables, Targets and Milestones (Tactical):

To be developed.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000					50 000	1

Tactic 3	Improving Species Knowledge: Long-billed Curlew

Status of Knowledge:

This is a species of Special Concern under COSEWIC, listed as Identified Wildlife, and blue-listed provincially. Scattered nest locations are known, primarily from the Robson Valley, but the species has been noted as well in Prince George and FS James forest districts. Our objective for this one would be to determine the breeding status of the curlew in the southern portions of the PG Forest region, and institute appropriate protective measures, such as the establishment of Wildlife Habitat Areas.

Tactical Summary:

The recommended tactic for this species is to determine the breeding status of the curlew in the southern portions of the PG Forest region, and institute appropriate protective measures, such as the establishment of Wildlife Habitat Areas.

Status:

New

Tactical Objectives:

Determine breeding status in southern region; and

Institute protection measures.

Tasks, Deliverables, Targets and Milestones (Tactical):

Continue the work started in 2001 in the Robson valley under the auspices of the Columbia Valley Compensation Program, to search for evidence of nesting and document the habitat. associations used by curlews throughout the southern portion of the PG Region.

Map distribution, determine breeding habitat – extension work may be required to educate private landholders, range lessees, on maintaining curlew habitat.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000				100 000	2

Tactic 4	Improving Species Knowledge: Lewis's Woodpecker

Status of Knowledge:

This is a species of Special Concern under COSEWIC and is blue-listed provincially, Vol. 1 IWMS. The range of this woodpecker is thought to include the Robson Valley, and some work has been undertaken in 2001 to try to ascertain this.

Tactical Summary:

The recommended tactic for this species is to clarify whether or not the species breeds in the PG Forest region, and determine appropriate protective measures for it, e.g., Wildlife Habitat Area designation.

Status:

New

Tactical Objectives:

Determine breeding status in the region; and

Design appropriate protective measures.

Tasks, Deliverables, Targets and Milestones (Tactical):

Continue the work started in 2001 in the Robson valley under the auspices of the Columbia Valley Compensation Program, to search for evidence of nesting and document the habitat associations used by Lewis' woodpecker throughout the southern portion of the PG Region, specifically in the Robson Valley forest district

Map the distribution and habitat.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000					50 000	1

Tactic 5	**Improving Species Knowledge: Sharp-tailed Grouse**

Status of Knowledge:

The Sharp tailed grouse, columbianus subspecies (Central Interior only) is blue-listed provincially, and is proposed for Vol. 2, IWMS. A provincial status report has been written for this subspecies, current up to 1995. Little or no regional or local information on the distribution of the species exists, and there is a need to acquire an understanding of the distribution, habitat needs and local life history for these birds in the PG Forest Region (Omineca sub-region). Records such as the 27 at a lek on the Nechako River in 1983 need to be re-visited.

Tactical Summary:

The recommended tactic for this species is to document the species distribution, habitat need and local life history

Status:

New

Tactical Objectives:

To determine species distribution;

To determine habitat needs; and

To determine local life history

Tasks, Deliverables, Targets and Milestones (Tactical):

Perform a sub-region-wide inventory of occurrences and associations, following a literature search and interviews with knowledgeable observers.

Build maps from this information - map distribution and determine habitat needs, both in terms of natural grasslands and early seral cutblocks

Model/ project habitat suitability/ capability (no specific model tool determined)

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000	50 000		200 000	4

Tactic 6	Improving Species Knowledge: Trumpeter Swan

Status of Knowledge:

This blue-listed identified wildlife species has been expanding its breeding range over the last several decades, and is assumed to be breeding in the northern parts of this region.

Tactical Summary:

The recommended tactic for this species is to determine the extent of the swan's breeding range, determine its habitat needs locally, and take steps, under Identified Wildlife or elsewhere, to protect breeding areas. This is a priority activity for the Dawson Creek Forest District.

Status:

New

Tactical Objectives:

Determine the breeding range;

Determine the habitat needs; and

Initiate appropriate protection measures for breeding areas.

Tasks, Deliverables, Targets and Milestones (Tactical):

Liase with the Canadian Wildlife Service and Ducks Unlimited Canada to determine the status of their knowledge of breeding swans in the PG Forest Region. As required, conduct a reconnaissance inventory and assessment of habitat use throughout the region, based on an analysis of potential suitable habitat, a literature search, and interviews with knowledgeable birders, foresters, landowners and other agencies.

Assemble known information and perform a GIS stratified search of appropriate wetlands for additional nesting birds

Quantify and characterise the winter habitat use by trumpeter swans of open water situations in our region

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000			150 000	3

Tactic 7 — Improving Species Knowledge: Peregrine Falcon (*anatum subspp.*)

Status of Knowledge:

Red-listed in B.C., breeding status in this region completely unknown.

Tactical Summary:

The recommended tactic for this species is to determine whether or not it exists as a breeding bird in the PG forest region, and then establish protective measures to maintain breeding sites. This is considered an ancillary priority within the Dawson Creek Forest District.

Status:

New

Tactical Objectives:

Determine breeding status; and

Initiate breeding site protective measures.

Tasks, Deliverables, Targets and Milestones (Tactical):

Conduct a reconnaissance inventory of potential breeding sites at appropriate season, based on GIS analysis for favoured features, i.e., cliffs of significant relief overlooking a broad gulf of air and a major water body, and preferably in an area having the potential for adequate amounts of suitable sized prey.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000				100 000	2

Tactic 8 Improving Species Knowledge: American White Pelican

Status of Knowledge:

This species is red-listed provincially, Vol. 1 IWMS species. A population of 75 to 100 pelicans has been known for several years to frequent the Nulki / Tachick / Stuart / Fraser Lakes vicinity during summer months. It is assumed that these are non-breeding birds, as no other breeding locality other than Stum Lake in the Cariboo has ever been located. However, the precise needs and movements of these red-listed birds remain largely a mystery.

Tactical Summary:

The recommended tactic for this species is to clarify the relationships of this population of birds to central interior habitats, and their relationship to the overall population of pelicans in B.C.

Status:

New

Tactical Objectives:

Determine habitat requirements and use by this population of pelicans; and

Determine the inter- relationship of this population to others in BC.

Tasks, Deliverables, Targets and Milestones (Tactical):

Marking and observation of PG region birds needs to be undertaken to ascertain their critical habitat needs, movements and patterns of behaviour in relation to the breeding bird colony at Stum Lake.

Continue capture, marking and telemetry studies to determine movement patterns and habitat needs

Consider the possibility of creating an artificial nesting island at Nulki or Tachick Lakes to establish a second breeding centre in B.C.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000				100 000	2

Tactic 9	**Improving Species Knowledge: Upland Sandpiper**

Status of Knowledge:

This is a blue-listed bird whose nesting status in the province remains a mystery. Broods of young upland sandpipers have been reported from various places around the province, including the Peace, but no nest has ever been verified, and southern records are questionable.

Tactical Summary:

The recommended tactic for this species is to clarify the breeding behaviour of the species in order to implement appropriate protective measures.

Status:

New

Tactical Objectives:

Determine the breeding behaviour and breeding habitat needs; and

Design appropriate breeding site protective measures.

Tasks, Deliverables, Targets and Milestones (Tactical):

Nest searches targeted on historical locations of brood and adult sightings in breeding season would confirm the species' breeding requirements and hence habitat protective measures. Given the remoteness and lack of access of the areas likely to be inventoried, the expense involved could be considerable.

Confirm breeding, as for warblers. This is considered an ancillary priority within the Dawson Creek Forest District.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000			150 000	3

Tactic 10 | **Improving Species Knowledge: Surf Scoter**

Status of Knowledge:

This species makes it on to the blue list by virtue of its restricted breeding range in B.C., though it is otherwise considered a common diving duck. No nests have been recorded in the province, though broods have been noted in the Peace and Fort Nelson lowlands. Impacts from forest development are likely to be minimal, and searches for nests would have to be conducted in likely very remote areas of NE B.C.; hence, this species is not likely to rate highly on a priority list of species data gaps. However, this species is considered an ancillary priority within the Dawson Creek Forest District.

Tactical Summary:

The recommended tactic for this species is to clarify the breeding behaviour of the species in order to implement appropriate protective measures.

Status:

New

Tactical Objectives:

Determine the breeding behaviour and breeding habitat needs; and

Design appropriate breeding site protective measures.

Tasks, Deliverables, Targets and Milestones (Tactical):

Nest searches targeted on historical locations of brood sightings and surf scoter aggregations in springtime would confirm the species' breeding requirements and hence habitat protective measures. Given the remoteness and lack of access of the areas likely to be inventoried, the expense involved could be considerable.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000			150 000	3

Tactic 11	Improving Species Knowledge: Nelson's Sharp Tailed and Le Conte's Sparrows

Status of Knowledge:

The Nelson's sharp-tailed sparrow is red-listed provincially, and proposed for Vol. 2, IWMS and, the Le Conte's Sparrow is blue-listed provincially. Both these grassland sparrows have been found breeding, to date, only in the Peace sub-region, but no systematic surveys have been done for them to determine their precise distribution. The South Peace Breeding Bird Atlas will go a long way towards clarifying their range, but directed work would be best to sample habitats throughout their expected range for their presence.

Tactical Summary:

The recommended tactic for these species is to determine the extent of its range, and it's preferred habitats, and local life histories. These species are considered an ancillary priority within the Dawson Creek Forest District.

Status:

New

Tactical Objectives:

To determine species distribution;

To determine habitat needs; and

To determine local life history

Tasks, Deliverables, Targets and Milestones (Tactical):

Conduct a reconnaissance inventory and assessment of habitat use throughout the region, based on an analysis of potential suitable habitat, a literature search, and interviews with knowledgeable birders.

Ground-truth any models of habitat suitability developed for either species

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000			150 000	3

Tactic 12	Improving Species Knowledge: Red and Blue Listed Plant Species and Associations

Status of Knowledge:

Variable

Tactical Summary:

The recommended tactic to improve knowledge of these plant species is to

determine the current status of historical records of red and blue listed plant species and associations;

attempt to expand and clarify their distribution maps; and

extend knowledge of their habitat characteristics (ecosystem associations and subzone variants) to resource users.

Status:

New

Tactical Objectives:

Assemble and summarise all known information regarding each species;

Enhance knowledge gaps through appropriate surveys and document/map their distribution; and

Initiate a suitable extension program aimed at awareness and protection/preservation.

Tasks, Deliverables, Targets and Milestones (Tactical):

Revisit all historical records of red and blue listed plant species and associations, to determine their presence or persistence at archived sites.

Conduct a detailed assessment of habitats at which the plants are found, with the aim of providing resource users with a model capable of predicting with some degree of accuracy where they might expect to encounter these associations.

Provide resource users with detailed descriptions of the plant associations and their habitats.

Institute protective measures where possible to preserve sites supporting these associations.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000				100 000	2

ISSUE 4: LACK OF GENERAL WILDLIFE HABITAT MANAGEMENT OBJECTIVES

Overview Description of the Regional Strategic Issue:

Improving the reliability, completeness and consolidation of wildlife habitat information will enhance the ability to establish clear and measurable management objectives for sustainable wildlife habitat management today and enable the monitoring and adaptation of the management objectives in the future.

Relationship to Sustainable Forest Management:

The maintenance of environmental values

General populations of wildlife and habitat availability are potentially at risk from forest development activities and a good understanding of the causes is uncertain. The census is incomplete for populations and so is habitat information for wildlife species not currently considered at risk (e.g. moose, elk, deer, pine marten and mountain goat). Inadequate or unreliable knowledge prevents the definition of clear and measurable management objectives, thereby frustrating effective management planning. Without a means of projecting the future supply of habitat for these wildlife species, a management strategy for most forest units is impossible.

Filling the knowledge gaps listed below would substantially improve decision making by introducing more certain and complete basic information/ data, enable the development of management options and empower a much more accurate evaluation of the implications of management decisions through:

Filling specific information gaps on life history, habitat requirements and sensitivities of specific species

Improving our understanding of certain wildlife species' and habitats' sensitivities to forest development activities

Developing data tracking systems that enable data compilation, analysis and data sharing

Developing accessible and useable predictive models

Monitoring the implementation of existing wildlife management strategies

Evaluating habitat and population related assumptions.

The sustainability of timber resources

For the most part these risks and uncertainties are related to operational costs, measurement of performance and diminishing timber availability due to withdrawals from the timber supply. Some of the more significant timber supply related risks and uncertainties exist in the following areas:

Wildlife tree retention, old growth management areas and other wildlife habitat related reserves

Clarity around the needs of certain species

Road access

Timing windows for operations in sensitive habitat areas or around sensitive features.

Completing habitat and modelling work can reduce the uncertainty for timber supply, and can in some cases, decrease the risk to and pressures on timber supply.

The sustainable use of non-timber resources

Likely, the most significant risks and uncertainties for users of wildlife that might be impacted by forestry/ wildlife interactions include:

First Nations- need for wildlife population information related to sustainable use levels of wildlife and support for determination of hunting opportunities (may effect treaty negotiations).

Hunting & Fishing – i.e. determination and monitoring of moose population dynamics needed to support hunting regulations and quota allocations

Recreationists & Tourists – i.e. backcountry hiking & camping, all terrain vehicle use etc.

Guides and trappers- i.e. potential elk-rancher conflict (Robson Valley, Vanderhoof, Ft. St. James).

Risks and uncertainties include access management; sport and commercial catch limits, maintenance of other forest values (i.e. viewscape, water quality).

Relationship to Strategic Resource Plans and Decisions:

Strategic Decisions:

Completing basic wildlife census information and habitat requirements and occurrence of features and required reserves will directly improve upcoming timber supply review decisions by providing insight into potential withdrawals from or additions to the availability of timber as a result of wildlife and wildlife habitat maintenance or enhancement activities.

Strategic Resource Plans:

All of the Omineca-Peace LRMP's provides general and specific direction on wildlife habitat and wildlife management. The implementation of this direction is currently hampered by the inadequacy of basic information on the presence/ absence of certain species, the lack of information on the sensitivity of certain species, and the absence of readily available tools to model the likely outcomes of management decisions.

The development and implementation of other plans, policies and procedures (i.e. Guidebooks, DM policies, SOP's, SFM Plans, LUP, IWMS, IFPA's) will be better informed and managers will be better able to monitor and adapt their management as appropriate.

TSR II is currently fully underway in the Omineca-Peace Region. With the completion of the Mackenzie LRMP in 2000, all LRMP's in the Omineca-Peace Region are now currently being implemented. The other strategic plan initiatives listed are currently either under development or are being implemented – the knowledge strategies are relevant now for plan development and monitoring and their value will increase over time

Cross Reference to Management Unit Issues:

There will be a need to recognise unique management unit knowledge needs and opportunities due to wildlife habitat variation across the region. The need for management unit specific knowledge will be identified through the prioritisation of knowledge gathering activities at a scale that is appropriate for addressing the management concern.

Status of Existing Knowledge:

Generally, there tends to be adequate knowledge on populations and habitat requirements for the species identified. Some effort needs to be expended in strengthening distribution information for some species (e.g. goats, goshawks, elk and some songbirds). For all of the species, the most significant knowledge gap is in identifying specific management issues and developing and implementing strategies to address these issues. More specifically, the status of the following categories of knowledge follows:

Organisation, synthesis and analysis:

PEM and TEM have been completed for only a very small portion of the Omineca-Peace Region (see Issue 1). Detailed ecosystem mapping offers planners a valuable tool for assessing the impacts of forest development on other natural communities. Wildlife habitat ratings define the relative importance of various ecological units to wildlife. The ratings reflect a habitat's potential to support a particular species by comparing habitat to the best available for that particular species in the province. Ecosystem mapping provides the framework for applying habitat ratings.

Inventory:

Table 3.4.1 presents a summary of the status of inventory knowledge for a number of general wildlife species.. The Tactical Planning Committee recommends that the status of inventory information on each species be undertaken as a priority.

There is currently no system or database for the storage and retrieval of information on the locations of key habitat resource features (i.e. mineral licks, game trails, rutting areas, natal areas, seeps) as it becomes known through field surveys. Such a data utility would facilitate improved species management planning.

Extension:

Some extension activities have been undertaken at the regional level for a number of the species.

Particularly lacking, however, is the assembly of available information and a co-ordinated extension plan.

Research:

Some research has been completed for a variety of sub-issues, additional research will likely be necessary. For example, the habitat requirements of wildlife species must be identified and prioritised at appropriate scales. Knowledge of regional and sub-regional, species-specific habitat dynamics and managed forest interactions is lacking, and requires further study.

Monitoring:

Some monitoring has taken place, additional monitoring needs to be undertaken. Development of monitoring systems as well as improving the use of existing systems should be undertaken.

Recommended Knowledge Solution:

General Approach:

Improving our understanding of certain wildlife species' and habitats' sensitivities to forest development activities is dependant upon both existing and the gathering of new information. Developing accessible and useable predictive models is also dependent upon existing and new information. Related, is the importance of focusing efforts on the sharing of technical expertise amongst professionals and between forest districts in the Region.

More Effective Use of Existing Information

Developing data tracking systems that enable data compilation, analysis and data sharing build upon existing information. Developing accessible and useable predictive models also builds upon existing knowledge, although the existing knowledge may have to be converted and/or verified. Evaluating habitat and population related assumptions and monitoring the implementation of wildlife management strategies also utilises existing information.

Gathering New Information

Strategies that fill specific information gaps on life history, habitat requirements, species specific sensitivities, and forestry related impacts, would significantly improve our ability to develop management scenarios, make informed management decisions, enable the monitoring and adaptation of management decision and assess the risk associated with management activities and decisions. Ensuring that this information is available to other stakeholders would facilitate this process.

Specific Solutions

The knowledge solution recommended to address the general wildlife management issue consists of six integrated strategies:

Wildlife Management Problem Analysis;

Wildlife Habitat Mapping;

Wildlife Habitat Research;

Species Knowledge

Wildlife Management Interpretations

Furbearer Habitat Use

Strategic Performance Indicators, Targets & Milestones:

Strategic performance indicators vary by strategy. Specific information is provided in Tactical descriptions.

Relationship to other SSFM Knowledge Strategies:

Each of the General Wildlife knowledge strategies is linked to the following other SSFM strategies:

Vegetation Resources Inventory Strategy

Ecosystem Mapping Strategy

Fish and Fish Habitat Management Strategies (3)

Decision Support Tools Strategies

Sustainable Harvest Strategies within each forest district.

Table 3.4.1 Status of Inventory and Habitat Knowledge for Selected General Species

Name	Population	Habitat	Distribution	Management Issue	Existing Management Strategy
Moose		known	P (anomalies in the existing information need to be explained)		
Elk		known	P		UWR
Mule Deer	N/A	known	known	Need more information on ungulate winter range	
Stone Sheep	known	known	known	Unknown – perhaps a need for a winter range management strategy?	UWR
Marten	N/A	Generally known at site level – not clear at landscape level	known	Would like to explore establishing a regional or sub-regional management strategy	Currently BDG – questionable success
Mountain Goat	P	known	P	Access; elimination of escape trails from mineral licks	IWMS
Waterfowl		known	known	Unknown?	FPC/ RMA
Goshawk	P	known	P	Goshawks are difficult to track over time. Unknown whether current strategies are effective for sustaining the Goshawk populations	IWMS and local SOP's

Strategy 1: Wildlife Species Knowledge

Tactic 1	General Wildlife Knowledge Problem Analysis

Status of Knowledge:

The level of species knowledge varies widely across this broad group of animal species. Data, information and knowledge tends to be incomplete and widely dispersed, thereby frustrating attempts to develop an efficient knowledge strategy for many species.

Tactical Summary:

Assessing and improving the reliability, completeness and consolidation of habitat inventory information for the identified wildlife species will enhance the ability to establish clear and measurable management objectives for the sustainable management and enhancement of these species populations and their habitats today and enable the monitoring and adaptation of the management objectives in the future.

An initial assessment of the status of wildlife inventory must be undertaken to inform decisions about the need to undertake other wildlife inventory related knowledge activities and the geographic scope of that need. As such, this simple but important activity must be initiated and completed early on in the implementation of the knowledge strategy and it must be done for the entire region.

Status:

New

Tactical Objectives:

Conduct a review of the state of knowledge for all significant wildlife species in the Omineca-Peace Region;

Perform a gap analysis for inventory information for each species to identify or confirm knowledge-limited general wildlife management issues (including sustainable forest development planning, access management and designation of conservation measures such as WHA's, SA's, OGMA's, and PMP zonations).

Ensure that identified knowledge gaps are addressed through recommendations for the design of new strategies or tactics, and that progress towards implementation of strategies and tactics is documented in status updates.

Tasks, Deliverables, Targets and Milestones (Tactical):

Establish the list of species that are of particular interest for management decisions (see Table 3.4.1).

Determine what knowledge initiatives are currently underway (e.g. regional wildlife plans) for each of these species

Determine the linkage between current initiatives and other knowledge strategies in the RMP.

Perform a gap analysis to determine where knowledge activities should be proposed to fill knowledge gaps.

Update this problem analysis and report on progress as recommended activities are undertaken and completed.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		30 000	5 000	5 000	5 000	5 000	50 000	5

Tactic 2	Improving General Species Knowledge
Activity 1	Moose

Status of Knowledge:

Because more resident, non-resident and First Nations hunt moose than hunt any other species, we need to continue to direct significant population management effort to collecting and interpreting data on moose population and status. Information on population dynamics will help to determine sustainable use levels.

Tactical Summary:

Increase our understanding of the abundance, composition (e.g., through annual calf:cow ratio estimates), and distribution, movements and mortality factors (wolves, hunting impacts) affecting moose.

Focus on areas where there are significant hunting pressures and road development that increases predation – i.e. Prince George FD, Ft. St. James FD, Mackenzie FD, Fort Nelson FD.

Status:

New

Tactical Objectives:

To provide information that supports proactive and sustainable forest development planning, access management and the judicious and appropriate designation of conservation measures (e.g. WHA's, SA's, OGMA's, PMP zonations).

Tasks, Deliverables, Targets and Milestones (Tactical):

To be developed via a tactical problem analysis and plan in the first year.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000	50 000	50 000	250 000	5

Activity 2	Mountain Goats

State of Knowledge:

To be determined.

Tactical Summary:

To be developed subject to a tactical problem analysis and plan in the first year.

Status:

New

Tactical Objectives:

To develop habitat and population information base for mountain goats, maintain & enhance mountain goat habitat (quality & diversity) and gain a better understanding of hunting and access pressures on populations and key habitats – adapt management in response to this better understanding. This tactic should be closely linked to Strategy 2, Project 3 (resource features data system).

Tasks, Deliverables, Targets and Milestones (Tactical):

Conduct census, assess population status, and investigate habitat use i.e. continue ongoing efforts in Robson Valley and expand to other districts.

Conduct inventory of goat distribution and abundance across the region.

The location of mineral lick sites can be a primary factor in goat distribution. This has significant ecological consequences in terms of forage availability, predation, and potential impacts from forestry activities and other development. The spatial distribution of licks with respect to available forage and escape terrain is a critical habitat requirement for goats and mineral licks. Therefore, mineral licks should be identified and protected.

Investigate goat use of lower elevation habitats i.e. access to mineral licks

Investigate interactions and impacts of backcountry recreation on goats and their habitat.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000	50 000	50 000	250 000	5

Activity 3	Elk

State of Knowledge:

To be determined

Tactical Summary:

To be developed subject to a tactical problem analysis and plan in the first year.

Status:

New

Tactical Objectives:

To identify, manage for and monitor elk habitat needs and preferences and to eventually develop management strategies that can be applied throughout the region (where appropriate) to maintain and enhance elk habitat quality and availability. To gain a better understanding of hunting and access pressures on populations and key habitats and adapt management in response to this better understanding. This activity should be closely linked to Strategy 2, Project 3 (resource features data system).

Tasks, Deliverables, Targets and Milestones (Tactical):

Determine areas where creation of early successional areas amidst mature deciduous and coniferous stands will benefit wildlife that rely on these habitats.

Develop habitat and population information base for Elk

Implement prescribed burning trials to re-establish grass/ shrubland areas and enhance ungulate forage amidst more mature forests (i.e. Mackenzie Ingenika Elk herd, Ft. Nelson elk). Such methods have the potential to benefit not only elk, but also moose, bears, and birds that rely on early seral dependent vegetation.

Monitor and evaluate vegetation and wildlife response/ success in prescribed burn areas.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000	50 000	50 000	250 000	5

Activity 4	Pine Marten

State of Knowledge:

Gilbert Proulx and Rhonda Kariz have produced 2 reports on marten in 2001, which summarise the life history, and habitat needs of the species in this area (1. Occurrence of American Marten and other Furbearers in TFL # 30, Prince George Forest District; Proulx, 2001; 2. Characteristics and Management of American Marten Habitat at Stand and Landscape Levels, submitted to Prince George Forest District, March 2001).

The co-authored report to the PG Forest District is an exhaustive review of literature on the species and its habitat associations. The work done in the McGregor Model Forest on developing a predictive model for marten occurrence appears to have met with excellent success. Six parameters of forest structure were used to predict 94% of marten occurrences.

Tactical Summary:

To be developed subject to a tactical problem analysis and plan in the first year.

Status:

New

Tactical Objectives:

To clarify Marten habitat needs across a broad cross-section of BEC zones and subzones, to develop models for predicting marten occurrence and habitat, and to develop prescriptions at the landscape and stand level across the region for maintaining marten populations in perpetuity.

Tasks, Deliverables, Targets and Milestones (Tactical):

Expand the PG Forest District work to other areas within the PG Forest District and to other management units in the region.

Verify and test the prescriptions for maintenance of marten populations on a managed, forested landscape suggested in the report.

Explore establishing a regional or sub-regional management strategy for marten management

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000	50 000	50 000	250 000	5

Tactic 3	Improving Sensitive Species and Populations Knowledge

Status of Knowledge:

A reasonable amount of population and habitat information exists for the species identified for general wildlife management (see Table 4.1). However, there may be significant knowledge gaps for other species or local populations which are not yet known to be "at risk" in the Omineca-Peace Region (see Issue 3).

Once these species or local populations are identified as "sensitive" to forest development disturbance, more detailed information on their occurrence and habitat use will be required. Design of appropriate research or monitoring programs will be then be necessary in order to:

quantify long-term population trends (declining, maintaining or increasing);

determine unique life history requirements in specific management unit;

identify sources of development and hunting pressures

design management unit strategies for the conservation of the species and/or its habitat (e.g. amount of equivalent clear-cut area; maximum density of development in a watershed, cumulative impacts).

Tactical Summary:

This tactic anticipates the importance of responding appropriately to perceived development pressures on general wildlife species or local populations.

It will be necessary to identify those species, or populations of wildlife (and their habitat) which are generally, or locally sensitive to forest development pressures such a forest harvesting, road construction and hunting;

It will be necessary to consolidate or expand information on wildlife habitat dynamics through investigations of species and habitat distribution, habitat supply thresholds, benchmarks, and understanding the role of development activities in habitat use. Of particular interest to resource managers will be an improved understanding of how to apply this information in making landscape level management decisions regarding development plans, access management plans and the judicious and appropriate designation of conservation measures (e.g. WHA's, SA's, OGMA's, PMP zonations).

Status:

New

Tactical Objectives:

To identify those wildlife species that are sensitive to general or local forest development and hunting pressures.

To enhance, through applied research and monitoring, the knowledge base for sensitive species.

Project Tasks, Deliverables, Targets and Milestones:

Determine which species that are of specific concern – i.e. sensitivities to development or hunting pressures, threat to viability of local or regional populations;

Confirm status of risk;

Assess the quality and utility of existing information and perform a gap analysis.

Establish research studies or monitoring systems that determine or confirm/ monitor species and habitat distribution and life history - Complete distribution and life history information for species

Determine habitat thresholds

Design level management recommendations;

Establish natural benchmarks

Explore the interactions of sensitive species or populations and their habitat with forest development activities, and determine their relative impacts against background, natural dynamics

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			100 000	50 000	50 000	50 000	350 000	5+

Strategy 2: Wildlife Habitat Mapping

Tactic 1	Habitat Prediction and Mapping

Status of Knowledge:

Specific habitat maps are a keystone decision-support of sustainable forest management. They are critical knowledge elements for landscape and site level planning to meet species habitat needs and to maintain habitat and ecological representation in the landscape. This tool is of particular importance for SFM management decisions related to areas such as:

landscape level strategic management decisions regarding the balance of development activities and the needs of different habitat dependant species

maintenance and enhancement of forest ecosystem condition and productivity;

multiple benefits to society and accepting society's responsibility for sustainable development;

biodiversity/species diversity management;

managing large scale perturbations such as pest infestations and fire

relative species/population and habitat risk management;

ecosystem resilience, and biomass and ecosystem productivity.

To improve the success of achieving sustainable forest management, the presentation of data and basic resource information must be clear and complete. Of particular concern, is the presentation of habitat information at the landscape level to support strategic management decisions about balancing development activities and the needs of different habitat dependant species?

To predict the outcomes of management decisions or scenarios, information inputs to prediction models must be reliable, complete and in formats appropriate to the decision support model.

Tactical Summary:

Wildlife habitat mapping is not complete for any species largely because bio-terrain mapping (PEM) has yet to be fully implemented. While full implementation of the Ecosystem Mapping Tactic of the VRI Strategy is a necessary pre-requisite, the habitat mapping strategy must be implemented for high priority management units (high priority being defined by the level of current and planned development and the sensitivity and variety of habitats known or suspected to exist in a management unit)

Habitat maps and suitability/capability interpretations rely on the development of suitable habitat prediction models. Habitat models require reliable ecological information; in some geographic areas this demands the collection of new base data. All data must be available in a "model-ready" format. These habitat data input criteria must be recognised and accommodated in other data-related strategies, most notably VRI, and various species specific strategies of this and the Species-at-Risk issue (e.g. regional wildlife habitat interpretations).

Model data input must also be compiled and it's reliability verified. Where gaps exist in either data quality or availability, these must be addressed through appropriate corrective action.

Status:

New

Tactical Objectives:

To predict with an acceptable level of confidence, habitat suitability and capability for all significant wildlife species in the Omineca-Peace Region.

Tasks, Deliverables, Targets and Milestones (Tactical):

This tactic comprises three related projects:

Habitat Interpretation Data – which addresses the assembly of available data, and the identification of priority data needs.

Habitat Modelling – which addresses the design, calibration and validation of suitable habitat prediction models.

Habitat Features Data - which addresses a specific type of habitat data

Activity 1	Habitat Data Assembly

Project Status:

New

Project Objectives:

Assemble and consolidate regional habitat interpretation data in suitable formats for habitat prediction modelling.

Project Tasks, Deliverables, Targets and Milestones:

Review, evaluate, and consolidate existing habitat interpretation data in the region. Initially this project will deal with existing data only, and should include a review of the suitability of data management systems. As new data is collected this task should be periodically updated

Perform a habitat data gap analysis to identify priority new data parameters required by habitat type;

Evaluate the means (best strategy or tactic) and relative efficiencies (using a cost/benefit analysis) of addressing identified data needs;

Report results and recommendations.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		30 000	5 000	5 000	5 000	5 000	50 000	5

Activity 2	Habitat Prediction Modeling

Project Status:

New

Project Objectives:

To predict with an acceptable level of confidence, habitat suitability and capability.

Project Tasks, Deliverables, Targets and Milestones:

Design habitat prediction models suitable for priority management needs;

Calibrate models using appropriate input data sets for selected landscape and wildlife species; it is estimated that at least 8 different habitat types may require local models

Validate models using independent, field derived data to evaluate predictive precision and utility of results.

Report on the precision and utility of the completed models;

Implement extension and training support on the use on the models;

Prepare map representations of model out.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		20 000	50 000	50 000	100 000	100 000	320 000	5

Activity 3	Habitat Features Data

Project Status:

New

Project Objectives:

Develop a data definition and data management system that addresses the need to identify and monitor priority wildlife habitat resource features as they are located during implementation of a variety of inventory strategies and tactics.

Early development and implementation of this new data system is recommended, since in some management units forest development pressures are intense and significant and important resource features or conglomerates of features are known to exist. In units such as these it is crucial that key habitat features are considered in management plans and decisions (e.g. WHA's, SA's, OGMA's, PMP zonations). The ultimate goal is to undertake habitat features inventories in all units systematically.

Project Tasks, Deliverables, Targets and Milestones:

Define a suitable data classification scheme for important stand (e.g. mineral licks, game trails, rutting areas, natal areas, seeps) and landscape (e.g. travel and connectivity corridors) habitat features;

Develop a data entry and data management system, or a modification of existing systems capable of entry, storage and retrieval of the resource data system.

Both tasks should be initiated in the first investment year. Input of known information (from Project 1) be completed by the second year, and subsequent investments must be made to maintain and update the tracking system on an annual basis or as new information becomes available.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		30 000	5 000	5 000	5 000	5 000	50 000	5

Strategy 3: Wildlife Management	
Tactic 1	Species Management Interpretations
Project 1	Mountain Goat Management

Status of Knowledge:

To be determined

Tactical Summary:

Explore establishing regional or sub-regional management guidelines for Mountain Goat

Status:

New

Tactical Objectives:

To ensure that viable populations of Mountain Goat persist in areas where development activities occur and to see whether development activities can complement wildlife management activities.

Tasks, Deliverables, Targets and Milestones (Tactical):

Set up a system to monitor and identify patterns in Mountain Goat responses to disturbance.

Develop management strategies from best practices and monitor successes and adapt management over time.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			10 000	10 000	5 000	5 000	30 000	4

Project 2	Goshawk Management

Status of Knowledge:

To be determined

Tactical Summary:

Explore establishing regional or sub-regional management guidelines for Goshawk

Status:

New

Tactical Objectives:

To ensure that viable populations of Goshawk persist in areas where development activities occur and to see whether development activities can complement wildlife management activities.

Tasks, Deliverables, Targets and Milestones (Tactical):

Set up a system to monitor and identify patterns in Goshawk responses to disturbance.

Develop management strategies from best practices and monitor successes and adapt management over time.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	10 000	10 000	5 000	5 000	80 000	5

Project 3	Pine Marten Management

Status of Knowledge:

Gilbert Proulx and Rhonda Kariz have produced 2 reports on marten in 2001, which summarise the life history, and habitat needs of the species in this area (1. Occurrence of American Marten and other Furbearers in TFL # 30, Prince George Forest District; Proulx, 2001; 2. Characteristics and Management of American Marten Habitat at Stand and Landscape Levels, submitted to Prince George Forest District, March 2001).

The co-authored report to the PG Forest District is an exhaustive review of literature on the species and its habitat associations. The work done in the McGregor Model Forest on developing a predictive model for marten occurrence appears to have met with excellent success. Six parameters of forest structure were used to predict 94% of marten occurrences.

Tactical Summary:

Explore establishing regional or sub-regional management guidelines for Pine Marten

Status:

New

Tactical Objectives:

To ensure that viable populations of Pine Marten persist in areas where development activities occur and to see whether development activities can complement wildlife management activities.

Tasks, Deliverables, Targets and Milestones (Tactical):

Set up a system to monitor and identify patterns in Goshawk responses to disturbance.

Develop management strategies from best practices and monitor successes and adapt management over time.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			10 000	10 000	5 000	5 000	30 000	4

Project 4	Songbirds Management

Status of Knowledge:

To be determined

Tactical Summary:

Explore establishing regional or sub-regional management guidelines for songbirds

Status:

New

Tactical Objectives:

To ensure that viable populations of songbirds persist in areas where development activities occur and to see whether development activities can complement wildlife management activities.

Tasks, Deliverables, Targets and Milestones (Tactical):

Set up a system to monitor and identify patterns in songbird's responses to disturbance.

Develop management strategies from best practices and monitor successes and adapt management over time.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			10 000	10 000	5 000	5 000	30 000	4

Project 5	Furbearer Management

Status of Knowledge:

To be determined during research problem analysis and project plan

Tactical Summary:

To be determined.

Status:

New

Tactical Objectives:

To provide information that supports proactive and sustainable forest development planning, access management and the judicious and appropriate designation of conservation measures (e.g. WHA's, SA's, OGMA's, PMP zonations). To enable timber and furbearer management to occur together and mitigate impacts to both in the Dunlevy area.

Tasks, Deliverables, Targets and Milestones (Tactical):

To be determined during research problem analysis and project plan

Tactical plan should be developed and implemented before development begins in the Dunlevy RMZ.

Cost Sharing:

Partnerships:

Dawson Creek Trappers Association

MWLAP Habitat

First Nations

LRMP Table

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		10 000	50 000	50 000	5 000	5 000	120 000	5

Tactic 2	Wildlife Management Extension

Status of Knowledge:

The level of species management knowledge varies widely across this broad group of animal species. Data, information and knowledge tend to be incomplete and widely dispersed.

Tactical Summary:

Improving the consolidation and availability of wildlife species management information and knowledge will enhance the ability to establish clear and measurable management objectives, and enable the monitoring and adaptation of the management objectives in the future.

Status:

New

Tactical Objectives:

To design new or improve existing media, systems and programs for assembling and extending species management information and knowledge in the Omineca-Peace Region.

Tasks, Deliverables, Targets and Milestones (Tactical):

Evaluate the suitability of existing extension initiatives;

Refine, re-design to improve the efficiency and effectiveness of species management information and knowledge extension to SFM decision-makers;

Implement the recommended media and extension program.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		25 000	50 000	50 000	50 000	50 000	50 000	5+

ISSUE 5: UNKNOWN NATURAL DISTURBANCE, BIODIVERSITY AND NATURAL SUGGESSION DYNAMICS BENCHMARKS

Overview Description of the Regional Strategic Issue:

Sustainable Forest Management incorporates forest condition objectives, which are intended to approximate the range of variability of the historic temporal and spatial patterns of forest distribution and seral stage conditions in the landscape. Certain aspects of this natural range of variability are poorly understood for the Omineca-Peace region. Adequate methods of monitoring and setting targets for biodiversity are also lacking and our knowledge of natural successional dynamics and processes is incomplete. These key knowledge gaps prevent meaningful habitat projections, accurate estimates for forest productivity and yields, and the development of effective biodiversity management strategies.

Relationship to Sustainable Forest Management:

The maintenance of environmental values:

Sustainable Forest Management incorporates forest condition objectives, which are intended to approximate the range of variability of the historic temporal and spatial patterns of forest distribution and seral stage conditions in the landscape. Certain aspects of this natural range of variability are poorly understood for the Omineca-Peace region. Adequate methods of monitoring and setting targets for biodiversity are also lacking and our knowledge of natural successional dynamics and processes is incomplete. These key knowledge gaps prevent meaningful habitat projections, accurate estimates for forest productivity and yields, and the development of effective biodiversity management strategies.

The sustainability of timber resources:

Currently we are managing for timber supply while making certain assumptions about impacts on other resource values, as we understand these impacts now. However, our understanding can & should be better. Many aspects of natural disturbance, biodiversity, and successional dynamics are not, for the most part well considered in these decisions. The short-term impacts on timber supply, of managing for ecological values are unknown but the long-term impacts of not managing for ecological values is almost certainly negative. It is known that CWD snags etc are important not only for wildlife values and stream structure, but for also maintaining the soil structure over time so the productivity of a site can be maintained into the future.

The sustainable use of non-timber resources:

Little is currently known about the current and future value of and demand for non-timber resources. Knowledge of natural disturbance and successional dynamics will assist in predicting and managing for adequate levels of non-timber resources in the future.

Relationship to Strategic Resource Plans and Decisions:

Strategic Decisions:

Addressing the knowledge gaps in natural disturbance, biodiversity, and successional dynamics can directly improve the upcoming timber supply reviews by strengthening confidence levels in some of the TSR forest management assumptions. It also has the potential to change the way we are currently managing the forest so in the next TSR we can more accurately predict the impacts of our decisions on future resource values.

Strategic Resource Plans:

All of the Omineca-Peace LRMP's give both general and specific management recommendations on a variety of natural disturbance, biodiversity, and successional dynamics issues. The benchmarking of these issues will enhance those recommendations or alter them to allow for better management within the differing resource management zones.

TSR II is currently underway. The information collected under natural disturbance, biodiversity, and successional dynamics would allow for better decisions to make in the data package supporting TSR III. Successional dynamics of mixed species forests for instance will be increasingly critical in all future TSR's.

Cross Reference to Management Unit Issues:

Status of Existing Knowledge:

Organisation, synthesis and analysis:

Necessary natural disturbance biodiversity and successional dynamics information is critically lacking in the Omineca-Peace Region.

Inventory:

In most cases inventories of one kind or another is what is required to resolve this issue. A variety of analyses of the resultant inventories would lend greater understanding to dynamics of the forest (especially the boreal forests in Peace-Liard).

Extension:

This is critical in all aspects of research/project completions yet has been left out of most projects.

Research:

There has been some research into some of the natural disturbance biodiversity and successional dynamics topics, however more information is required to mange for natural disturbance biodiversity and successional dynamics properly.

Monitoring:

Monitoring of very few projects have been completed, and no monitoring programs have been initiated to measure biodiversity or successional development.

Recommended Knowledge Solution:

General Approach:

We currently lack the necessary information to develop forest management strategies that will approximate natural disturbance, limit our impact on biodiversity and work in concert with natural successional dynamics. Knowledge gaps will be filled in critical areas by:

using current inventory information and GIS to analyse the temporal and spatial characteristics of different age forests;

establishing a network of permanent plots and transects to establish benchmark criteria to monitor our forest practices against; and

conducting new research to examine different aspects of natural disturbance, biodiversity assessment and successional dynamics in different landscapes. Most of the Strategies, Tactics and Projects under this issue are either new or represent the completion of existing work.

Specific Solutions:

The knowledge solution recommended to address the Natural Disturbance, Biodiversity and Natural Benchmarks issue consists of three integrated knowledge strategies:

Natural Disturbance Benchmarks;

Disturbance Features Research; and

Biodiversity Research.

Strategic Performance Indicators, Targets & Milestones:

Strategic performance indicators vary by strategy. Specific information is provided in Tactical descriptions.

Relationship to other SSFM Knowledge Strategies

Strategy 1 is linked to several strategies associated with Issue 1 (Unreliable Resource Inventories.

Strategy 2 is linked to strategies addressing Issue 8 (Mixedwood Stand Dynamics), Issue 10 (Lack of Alternative Harvesting Experience) and Issue 12 (Lack of or Incomplete Visual Resource Management Objectives).

Both strategies are related to Issue 13 (Managed Stand Productivity Potential).

Strategy 1: Natural Disturbance Benchmarks

Tactic 1	Natural Disturbance Inventory

Status of Knowledge:

Necessary natural disturbance biodiversity and successional dynamics information is critically lacking in the Omineca-Peace Region.

Tactical Summary:

This tactic calls for an inventory of the forest structural elements, which reflect natural disturbance, biodiversity, and successional dynamics. This inventory initiative should be completed in all districts within the Omineca Peace Region. Some districts may have portions of the inventory completed.

A multi-resource, multi-level, multi-variable inventory data collection procedure is advocated, whereby as many inventory data elements are estimated as possible in a single inventory sample plan.

Status:

New

Tactical Objectives:

The objective is to collect baseline information for:

vegetation (stand structure – size, horizontal and vertical structure, snags, coarse woody debris, and species composition); and

wildlife (species richness and distribution) for different combinations of habitat type, time since disturbance and disturbance type (fire, bugs, windthrow)

for different Natural Disturbance Types

Tasks, Deliverables, Targets and Milestones (Tactical):

Define a sampling matrix

Refine/develop sampling protocols for vegetation and wildlife

Establish which existing sampling is appropriate for inclusion in the sampling matrix (gap analysis). Do existing projects/report information fit the sampling protocol

Develop a long term sampling plan

Review long term sampling plan for effectiveness and efficiencies:

To define seral stage stand attributes

Correlate information to existing information

Utilise information on a course filter basis within 2-5years

Complete fieldwork

Compile information

Analyse information

Report

Extension (training seminars and workshops)

Monitor

The first 5 tasks should be completed by March 31, 2002

The remaining tasks should be completed in the next 2-5 years, with extension to follow.

A Monitoring plan should be designed to follow the inventory phase

Cost Sharing:

Some of the elements within the inventory have been completed by Multi-year agreement holders, by Annual agreement funding, some by IFPAs, the MOF and MSRM and MWALP projects. It is anticipated that all forms of funding agreements can be utilised in the funding of the inventory.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
2 000 000	4	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	10 000 000	5

Tactic 2	Natural Disturbance Type Mapping

Status of Knowledge:

Several Natural DisturbanceTypes (NDT's) have been misclassified in the past using the best information available at the time. New or better information is now available to refine the NDT boundary lines, based on the original principles for NDT boundaries

Tactical Summary:

To be developed.

Status:

Ongoing

Tactical Objectives:

To provide better NDT boundaries with which to manage landscape unit planning

Tasks, Deliverables, Targets and Milestones (Tactical):

Obtain better information from licensees

Identify new boundary lines

Map new boundary lines

Disseminate to districts and licensees

Report and Extension to identify why line changes were made.

The boundary line changes should be completed by March 31, 2002 with mapping and extension to follow in the next fiscal year.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		30 000						1

Tactic 3	Old Forest Patch Characterization

Status of Knowledge:

For many of the biogeoclimatic units' old patch size information has not yet been identified and has been extrapolated from current information. It is known that old patch size varies and will have an impact on landscape unit planning and future management of the land base. Old patch benchmarking needs to be completed for the region to properly manage the land base.

Tactical Summary:

Status:

On-going

Tactical Objectives:

Complete old patch benchmarking for the region by determining the patch size distribution of old forest under a given natural disturbance regime (WTP/OGMA).

Tasks, Deliverables, Targets and Milestones (Tactical):

Phase 1 – Utilises existing information, and should be completed over the next three fiscal years

Select criteria (e.g. age, structure, stand density, understorey development, CWD, WT's/snags) to define "Old" using known information and analysis tools

Implement for one biogeoclimatic zone at a time – for example: Plateau – SBSmk1 – associated with different fire return intervals

Compare results with existing OGMA maps

Report and Extension

Phase 2 - As new baseline information is made available, after two to three fiscal years, phase two of this tactic should begin

Select criteria based on "Old" from Strategy 1, Tactic 1 (Natural Disturbance Inventory).

Implement throughout the region

Compare results with existing OGMA maps

Examine strategies to ensure Old patch distribution (size/shape) over time

Cost Sharing:

Partnerships:

Licensees; MWALP, MSRM

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	150 000	150 000	150 000	650 000	5

Strategy 2: Disturbance Features Research

Tactic 1	Forest Cover Gap Research

Status of Knowledge:

While most research attention has focussed on forest layers, non-forest vegetation associated with forest canopy gaps are thought to provides an important contribution to forest biodiversity. The characteristics and dynamics of these non-forest vegetation patches, and their role in stand successional development structural pattern are little known, and require investigation. Without this knowledge, there is concern that conventional, homogeneous silvicultural practices, such as site preparation, may result in a more continuous pattern of forest cover, thereby altering previous natural patterns.

Tactical Summary:

The recommended knowledge tactic is to analyse all current and future new natural disturbance inventory information, in combination with selected empirical studies, to compare and contrast the structural characteristics of natural and managed forests. The purpose of these investigations is to detect any variation between both conditions in the frequency and pattern of forest canopy gaps (non-forest vegetation patches), and to explore and recommend forest management options for simulating natural patterns in managed landscapes.

Status:

New

Tactical Objectives:

Identify the "natural" pattern (distribution, density) of forest vegetation to enable harvesting and silviculture practices to mimic or approximate natural conditions.

Tasks, Deliverables, Targets and Milestones (Tactical):

This Tactic should consist of 2 related investigations implemented in tandem during the five year plan

Forest Cover Gap Data Analysis and Interpretation – this project explores existing inventory information to derive a natural vs. managed forest comparison. It also incorporates new data and information as it becomes available through Strategy 1, Tactic 1 implementation, and continually updates the interpretations over the life of that inventory initiative. This will ensures that a direct linkage between these initiatives is maintained, which will maximise the efficiency of the analysis and the accuracy of the management interpretations.

Forest Cover Gap Empirical Research – in combination with Project 1, this relies on the analysis of aerial photography interpretation of selected ecosystems, with field confirmation, to derive natural vs. managed forest cover gaps comparisons.

Both projects are designed to be mutually complimentary, as well as jointly complimentary to Strategy 1, Tactic 1 (Natural Disturbance Inventory).

Specific details are provided at the project level.

Research problem analysis (including natural disturbance/habitat literature review

Research plan development.

Research plan implementation.

Reporting and Extension

Project 1	Forest Cover Gap Data Analysis and Interpretation

Project Status:

New

Project Objectives:

Compare and contrast natural and managed forest cover gap characteristics;

Derive forest management interpretations, implications to vegetation dynamics and natural successional patterns, and recommendations for simulating natural patterns of non-forest vegetation in the managed forest.

Project Tasks, Deliverables, Targets and Milestones:

Phase 1 – Analysis and Interpretation of Existing Data and Information

Assemble inventory data base and information on patterns of forest succession from existing sources, including TEM, VRI, ecosystem assessments, research projects, and operational trials;

Define non-forest vegetation attributes, and undertake a spatial analysis of the existing inventory data base for both natural and forest cover managed polygons;

Conduct a similarity analysis of managed and natural forest cover gaps, and interpret the significance of the results in terms of impacts of management on natural patterns of forest cover gaps and ecosystem succession;

Develop management interpretations.

Conduct Extension of Phase 1 results and recommendations.

Phase 2 - Analysis and Interpretation of New Data and Information

Annually, assemble new natural disturbance inventory data resulting from Strategy 1, Tactic 1 (Natural Disturbance Inventory);

Conduct similar analyses as Phase 1 employing the improved database;

Use enhanced data and information base to refine understanding of patterns of forest succession;

Estimate the habitat use or biodiversity value of the gaps over time and space;

Evaluate forest timber and habitat supply implications of modified forest gap practices;

Conduct extension of Phase 2 results and recommendations.

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	250 000	250 000	250 000	300 000	1 150 000	5

Project 2	Forest Cover Gap Empirical Research

Project Status:

New

Project Objectives:

Compare and contrast natural and managed forest cover gap characteristics;

Derive forest management interpretations, implications to vegetation dynamics and natural successional patterns, and recommendations for simulating natural patterns of non-forest vegetation in the managed forest.

Project Tasks, Deliverables, Targets and Milestones:

Assemble inventory data base and information on patterns of forest succession from existing and new sources (output of Project 1);

Use enhanced data and information base to refine understanding of patterns of forest succession;

Undertake gap analysis/assessment of selected or representative BEC zones from existing air or orthophotography.

Examine/assess the habitat use or biodiversity value of the gaps over time and space.

Review silviculture practices that may be suitable for select/target BEC zones.

Recommend management strategies to achieve desired pattern using appropriate silviculture practices.

Evaluate forest timber and habitat supply implications of modified forest gap practices;

Conduct extension of results and recommendations.

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		150 000	150 000	150 000	150 000	150 000	750 000	5

Tactic 2	Harvest Pattern Impacts Research

Status of Knowledge:

There is much uncertainty and debate regarding the relative impacts to disturbance pattern and biodiversity of silvicultural systems and harvest pattern design.

For example, there is disagreement regarding small patch size vs. large patch size management practices. Extensive small patches, such as those created by group selection partial cuts may lead to extensive road networks that have greater direct and indirect impacts on terrestrial and aquatic organisms than those of large patches. The cumulative effects of access and disturbance associated with various harvest patterns require further study.

Tactical Summary:

Status:

New

Tactical Objectives:

To determine the impacts of harvesting design on forest level biodiversity and disturbance patterns.

Tasks, Deliverables, Targets and Milestones (Tactical):

Research problem analysis (including natural disturbance/habitat literature review);

Research plan development. Methods may include:

- Analyse the impacts of current management employing small versus large patch sizes;
- Contrast and compare impacts on water quality, biodiversity wildlife habitat use and other measures of ecosystem quality with natural fire return patch size;
- Identify optimum managed forest patch size distributions based on natural patch sizes, biodiversity concerns and impacts.
- Research plan implementation
- Reporting and Extension

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		150 000	150 000	150 000	150 000	150 000	750 000	2

Strategy 3: Biodiversity Research

Tactic 1	Plant and Animal Disturbance Niche Research

Status of Knowledge:

Assembly of knowledge to be undertaken during problem analysis.

Tactical Summary:

Fire, pests and windthrow create habitat for birds and animals that is difficult to mimic. Currently the most common harvesting system is clearcutting. This tactic consists of a research investigation of the relationship between plant and animal habitat requirements, and natural disturbance. Resulting information and knowledge will facilitate better management decisions to mimic natural disturbance features and patterns.

Status:

New

Tactical Objectives:

To identify characteristics and species associated with disturbance to enable managers to better manage for disturbance at a landscape and stand level.

Tasks, Deliverables, Targets and Milestones (Tactical):

Research problem analysis (including natural disturbance/habitat literature review

Research plan development.

Research plan implementation

Reporting and Extension

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	30 000					2

Tactic 2	Wildlife Connectivity Research

Status of Knowledge:

The validity of the wildlife management concept of connectivity is unclear.

Tactical Summary:

A review will be undertaken to determine the validity of connectivity in the Omineca-Peace Region.

Status:

New

Tactical Objectives:

To determine the validity of the concept of connectivity;

To develop quantitative or qualitative parameters which define connectivity;

To evaluate the quantitative and qualitative status of connectivity remaining in the Timber Harvesting Landbase of TSA's (including wildlife corridors and FEN's, by BEC zone and NDT).

Tasks, Deliverables, Targets and Milestones (Tactical):

Research problem analysis (including a literature review of the concept or application of connectivity);

Research plan development.

Research plan implementation

Reporting and Extension

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		80 000	220 000	50 000				3

Tactic 3	Gene Transfer/Population Vigor Research

Status of Knowledge:

The health of a species or population has been related to the degree of gene transfer within that population. Healthy populations express a high degree of gene transfer whereas in low vigour, declining populations, the transfer of genetic material (gene flow) is constrained.

Tactical Summary:

To be determined through problem analysis and project planning. Possible rationale:

Age structure indicates whether populations are increasing, decreasing, or stable. Age structure combined with reproduction data can help determine specific factors that regulate populations. For example, data on reproductive rates, sex ratios, and age structures can be used to calculate gross natality. Age structure and reproduction are also good indicators of habitat quality, whereas density could be misleading as a measure of habitat quality by failing to distinguish between ecological sources and sinks

Status:

New

Tactical Objectives:

To determine the status of gene transfer within important populations of wildlife.

Tasks, Deliverables, Targets and Milestones (Tactical):

Research problem analysis (including a literature review of the concept of genetic vigour of wildlife populations;

Research plan development. Experimental methods may include:

Identify indicator species that are associated with specific seral stages and whose welfare is indicative of the welfare of other species inhabiting similar habitats.

Identify/develop sampling protocols for population structure.

Establish and test sampling units.

Develop long-term sampling plans.

Review long-term sampling plans for effectiveness.

Research plan implementation

Reporting and Extension

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
				100 000	200 000	100 000	400 000	3

ISSUE 6: INADEQUATE SUSTAINABLE FOREST MANAGEMENT DECISION SUPPORT TOOLS

Overview Description of the Regional Strategic Issue:

Successful achievement of sustainable forest management in the Omineca-Peace Region may be constrained by the ability of managers to make complex resource decisions at many levels of SFM. This problem arises due to the nature of the sustainable forest management concept and the state of forest management technology; specifically:

Imprecise definition(s) applied to SFM

Lack of objective, measurable criteria and indicators of achievement.

Imperfect knowledge of the structure and function of terrestrial and aquatic forest ecosystems and their response to management intervention.

Inefficient application of knowledge resources to SFM problem solving and decision support.

This SSFM issue addresses the fourth cause of the problem, and provides recommendations for improvement of SFM decision support.

A suitable framework is required for the discussion Sustainable Forest Management decision support. Such a framework should integrate the following six elements, or pre-requisites:

SFM objectives are clearly defined and measurable;

The forest ecosystem is analysed, and broad management strategies are designed to achieve the objectives;

Specific intervention tactics are selected for most effective implementation the forest level strategies;

Operational programs are planned for the most efficient application of the desired intervention tactics in space and time;

The management programs are implemented in the forest; and

The ecosystem, landscape and forest level responses to management interventions are periodically evaluated, analysed, and SFM objectives and plans (strategic, tactical, and operational) are revised where necessary, based on actual forest ecosystem performance.

Although SFM decisions occur within each these elements, only those concerning the last five are dealt with explicitly in this analysis.

Relationship to Sustainable Forest Management:

The maintenance of environmental values:

Failure to satisfy any of the six SFM pre-requisite elements increases the probability of incorrect or inadequate management decisions, failure to achieve SFM, and the likelihood of environmental degradation.

The sustainable use of timber resources:

Failure to satisfy any of the six SFM pre-requisite elements increases the probability of incorrect or inadequate management decisions, failure to achieve a sustainable supply of timber, and increases risk of inefficient operational investments.

The sustainable use of non-timber resources:

Failure to satisfy any of the six SFM pre-requisite elements increases the probability of incorrect or inadequate management decisions, failure to achieve a sustainable supply of non-timber resources or resource values (i.e. viewscape, water quality, wildlife and fish populations and habitat). Those likely most affected by the resulting risks and uncertainties associated with incorrect, poorly informed decisions include:

First Nations

Recreationists

Tourists

Guides and trappers

Relationship to Strategic Resource Plans and Decisions:

Strategic Decisions

If strategic management decisions are based on faulty or inadequate analysis of the structure and function of those forest ecosystems comprising the forest management unit, there is greater probability that the forest will respond differently to management than required to meet sustainable forest management objectives. The potential implications are the same regardless of the resource under management; resource utilisation in excess of that which is sustainable.

Strategic Resource Plans

All of the Omineca-Peace LRMP's provide both general and specific management recommendations on a variety of SFM elements. The successful implementation of many LRMP recommendations is limited due to the absence of decision support tools (i.e. basic data, analysis tools, models and projections) to enable managers to develop a variety of management scenarios, project likely outcomes, select a course of action, measure the success and evaluate the need to adapt the management.

The development and implementation of other plans, policies and procedures (i.e. TWM, DM policies, SOP's, SFM Plans, LUP, IWMS, IFPA's) will be better informed and managers will be better able to monitor and adapt their management as appropriate if the required decision support resources are made available.

TSR II is currently underway in the Omineca-Peace Region. With the completion of the Mackenzie LRMP in 2000, all LRMP's in the Omineca-Peace Region are now currently being implemented. The other strategic plan initiatives listed are currently either under development or are being implemented. The solutions recommended for resolving decision support gaps are immediately relevant for plan development and monitoring and their value will increase over time.

Cross Reference to Management Unit Issues:

Recommended Knowledge Solution:

The process for making resource management decisions involves three steps:

Define the problem – inputs of information and knowledge enable the evaluation of the current situation relative to management objectives and timeframe, and the state and dynamics of the forest ecosystem;

Consider/model probable outcomes and risks associated with different decisions, then select the most suitable within the context of the problem; and

Monitor decision outcome – evaluate the results of the management decision and identify the need to change the decision.

Information and knowledge are key elements of all decisions; basic information and refined knowledge are needed in all three steps.

The design or improving of six types of SFM decision-support tools is recommended:

Objective seeking decisions;

Strategy-setting decisions;

Tactical design decisions;

Program planning decisions;

Operational implementation decisions; and

Performance monitoring decisions

This knowledge solution will require the validation and consolidation of existing data and information. Significant data gaps exist and modelling capability must be improved.

Status of Existing Knowledge:

Organisation, synthesis and analysis:

A number of SFM analysis tools already exist (i.e. predictive habitat models, projection models, VRI, GIS) but their use is limited in some cases by gaps in input data, and in other cases by the inaccessibility of the support tool (i.e. financial, training).

Inventory:

Inventory information needs and knowledge gaps are best identified by the tactical planning teams.

Extension:

One of the recommended knowledge activities will be to identify SFM decision support tool users (the audience) and their needs

Currently, SFM decision support tool extension activities are either weak or absent.

Research:

Some research has been completed for a variety of sub-issues, additional research will likely be necessary – needs must be identified and prioritised at appropriate scales and for those sub-issues where a need is identified.

Monitoring:

Some monitoring of the success of SFM decisions has taken place, additional monitoring needs to be undertaken. Development of monitoring systems as well as using existing systems needs to be undertaken.

Describe the Required Knowledge-Building Activities in these Areas (as applicable):

Inventories – VRI

A full Vegetation Resources Inventory is a pre-requisite for many other knowledge strategies, and a foundation for most types of SFM decision support.

VRI information supports definition of many of the key SFM indicators, including the conservation of biological and species diversity; maintenance of ecosystem diversity (e.g. a reflection of forest disturbances and stress both naturally occurring and human-induced); multiple benefits to society (e.g. a reflection of different ecological values and resources).

VRI needs to be completed for the entire region, with high priority management units (high priority being defined by the level of development currently and planned and the sensitivity and variety of habitats known or suspected to exist in a management unit) completed first. Development of a number of key decision support tools recommended in other knowledge solutions and strategies are dependent on the regional implementation of VRI.

Full adoption and implementation of the recommendations presented in Issue 1, Strategy 1 are therefore advocated.

Ecological Mapping

Completion of ecological mapping in key areas throughout the region is recommended. There are many uses for this knowledge, including understanding and improving the management of landscape and forest level structure and ecology. It is particularly important for supporting decisions concerning biodiversity, silvicultural treatment regimes, species-at-risk populations and habitat, and landscape scale forest disturbances such as pest infestation and fire. Development of a number of specific habitat prediction models in other knowledge strategies is contingent on completion of bio-terrain based ecological mapping.

Full adoption and implementation of the recommendations presented in Issue 1, Strategy 3 are therefore advocated.

Watershed Sensitivity Analysis

This specific knowledge strategy is recommended to provide basic watershed management information to decision-makers in an organised and synthesised format. The water resource is linked to all aspects of sustainable forest management. The purpose of this strategy is to facilitate a better understanding of the relationship between forest management interventions and the ecological function of the watersheds in which they are to be undertaken.

This decision resource will be support most management decisions, including biodiversity management, maintenance and enhancement of forest ecosystem condition and productivity, conservation of soil and water resources, forest ecosystem contributions to global ecological cycles, multiple benefits to society and accepting society's responsibility for sustainable development. In particular, it will reduce uncertainty in decisions concerning sensitive fish species and their habitats, community water uses, and soil and terrain hazards.

Regional implementation of watershed sensitivity analysis requires the collection and synthesis of new data; therefore, a gap analysis of the availability and reliability of existing information is recommended. Identification and prioritisation of all watersheds should be undertaken immediately, followed by preparation of an analysis implementation plan; this approach will ensure efficient data and information collection.

Biodiversity Management Unit Boundaries

Currently, biodiversity management initiatives under provincial policy are based on delineation Landscape Units and specification of management objectives under the Forest Practices Code.

The establishment of ecologically significant biodiversity management units is fundamental to SFM decisions, including biodiversity management; maintenance and enhancement of forest ecosystem condition and productivity; conservation of soil and water resources; forest ecosystem contributions to global ecological cycles; multiple benefits to society and accepting society's responsibility for sustainable development.

The local applicability and relevance of ecological management objectives must therefore be verified.

Full implementation of the recommendations in Issue 1, Strategy 3 is therefore advocated.

Risk Assessment Decision Support

Development of risk assessment methods is recommended for a wide range of SFM applications. These decision support tools will assist managers select cost-effective resource management options, thereby improving the allocation of increasingly scarce operational funds.

The introduction of risk assessment methods will significantly improve decisions having impacts on biodiversity, maintenance and enhancement of forest ecosystem condition and productivity, conservation of soil and water resources, multiple benefits to society and accepting society's responsibility for sustainable development. In particular, uncertainties associated with the management of disturbances and stress, soil and water quality, species diversity, ecosystem resilience, biomass and ecosystem productivity, forestland conversion, productive capacity of the economy, contributions to the economy, and supporting forest communities can be better addressed from the perspective of management of risk.

Investments in risk-based decision support systems for silviculture and stream management applications should be undertaken as a priority. Risks associated with a number of related issues have become a concern:

riparian and stream crossing disturbance;

regenerated stands approaching their late free growing dates; and

backlog silviculture and regeneration of beetle salvage areas.

Visual Landscape and Recreation Inventories

Most of the LRMP's in the Omineca-Peace region identify the management of recreation values and visual quality as a prime concern. In some cases, plans recommend specific viewscape management objectives. Unfortunately, while much of this work identified the public's concerns and sensitivities for particular viewscapes or for recreation features, the necessary inventory of visual sensitivity and recreation resources has yet to be completed.

Full implementation of the recommendations contained in Issue 1, Strategy 2, and Issue 12, Strategies 1 and 2 are advocated.

Predicting Stand and Forest Dynamics

Stand dynamics is the on-going succession of structural changes resulting from the growth of a single community of trees. Understanding the dynamics of stand growth is crucial to reliably predicting future patterns of stand development, and provides a basis for prescribing stand level silvicultural interventions.

Predicting the growth, yield and dynamics of individual managed stands is a reasonably developed technology, especially for simple, single species regimes. Stand and tree models for more complex stands are much less well-developed, and considerably greater research and development investment is required to design and validate suitable yield models for most of the common species mixtures and stratified stand types in the Omineca-Peace Region.

A forest consists of a variety of stand types in a variety of growth phases. Forest dynamics is the on-going succession of change in the pattern of stand types and age classes across the whole forest. Sustainable forest management is the practice of controlling the spatial and temporal dynamics of the whole forest. The purpose of forest management is to modify forest dynamics, if necessary, to create or maintain a whole-forest pattern of stands which best satisfies the objectives of the forest owner.

Forest management objectives incorporate public forest values, and reflect resource user demands for specific goods, services and forest conditions. The current structure and future dynamics of the whole forest determines the availability and sustainability of forest values, and the degree to which forest level objectives are achievable. Most forest values are related to one or a combination of the following factors (Baskerville 1995):

a specific stand type.

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5 Baskerville, G. 1986. Understanding forest management. The Forestry Chronicle, August 1986. p. 339-347

a specific pattern of stand types,

a specific stage of stand development, or

a specific pattern of stand development stages.

For example, a steady flow of timber depends on the continuous availability of stands of suitable age and structure to permit economic harvesting. A reliable community water supply depends on the geographic location and pattern of stands of a specific size and structure within a forest watershed. Preservation or enhancement of forest habitat and biodiversity depends on a perpetual mosaic of stands with a variable and complimentary stand structure throughout a forest.

Understanding forest dynamics is as important to forest management as an understanding of stand dynamics is to stand level, silvicultural interventions. Analysis of forest dynamics requires accurate information and a thorough knowledge of the structure and spatial pattern of the forest, as well as the natural or man-caused interventions that contributed to the current state of the forest.

Forest analysis provides an objective means of evaluating resource supply capacity, the feasibility of forest level objectives, and the potential for specific management actions to correct supply problems to achieve resource objectives.

Specifically, forest analysis provides two decision support functions:

a forecast of future forest dynamics, a supply schedule of desired forest resources, and a measure of the achievement of forest management objectives, and

a sensitivity analysis which indicates the key factor(s) acting to constrain the achievement of forest management objectives.

Forecasting resource supply and forest dynamics is a difficult task because:

Forest estates are typically large, structurally complex and subject to a large number of natural and management disturbances (harvesting, wildfire, pest destruction etc.).

Forest resources are allocated on the basis of a suite of often-conflicting forest values.

Forest resource supply is a function of many factors interacting over long time periods at several scales; changes in a single, limiting factor may result in unexpected changes in the supply of one or more resources at some time in the future.

Stand level management action necessary to modify forest dynamics and enhance resource supply requires a long response time, and implementation at usually a large scale.

Computerised decision support systems simplify the mathematics required in forest analyses. Many such forest estate models are available, but more research and development is required to improve their suitability.

Forest supply models are used to simulate the dynamics of actual forest estates, and provide a strategic test bed for evaluating the interactions of a wide range of resource objectives, constraints, and management actions.

Most forest supply scheduling models are multi-component systems that incorporate various combinations of simulation modelling, optimisation techniques, heuristics, mixed integer programming and geographic information systems (GIS). Selecting a specific model or a type of model depends on many factors. All forest supply models should include the following attributes:

accurate representation of the way forests are harvested, including the spatial distribution of harvests.

capability to account for harvest impacts on non-timber resources.

capacity to enable a forecast period of one rotation or longer.

provision of reasonable analytical detail representative of the forecast period and the level of precision in the data.

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[5] Naesset, E.W. 1997. A spatial decision support system for long-term forest management planning by means of linear programming and a geographic information system. Scandinavian Journal of Forest Research 12: p.77-88.

provision of reports on timber and non-timber resource supply, and management activities.

Spatially explicit decision support systems (SDSS) currently provide the most realistic forest resource supply forecasts. Ecological processes, forest dynamics and landscape structures are equally dependent on both the spatial and temporal dimension. Forest analyses based on aspatial supply models are incapable of simulating the landscape relationships and interactions, which now must be considered in forest management decision making. . Spatial constraints are difficult to anticipate unless a spatially explicit supply model is used for supply scheduling.

SDSS supply models rely on either simulation or optimisation techniques, coupled with a geographic information system (GIS). Each stand type in the supply model corresponds to a map unit with known geographic position within the GIS. Forecast states of each stand type can be thematically mapped at any period in the forecast to permit evaluation of spatially sensitive forest values. Incorporation of digital elevation models in some SDS systems provides three-dimensional simulation of landscape views. SDSS resource supply scheduling also facilitates easier identification of stand-level prescriptions based on strategic decisions, thereby preserving consistency between the strategic, tactical and operational levels of forest management.[6]

SDSS supply modelling is a rapidly evolving technology with many forest management benefits. However, regardless of the type of stand projection or forest estate model used, all models share an important limitation; they are capable only of approximating real stand and forest conditions. All models represent a balance between the need for simplicity and practicality, and the need to adequately account for the complexities of the stand and forest situation.

As a result of this trade-off, it isn't possible to model forest supply characteristics with great precision. Nevertheless, models are indispensable decision support systems for assessing and anticipating forest-level supply problems.

All forest supply models require three information inputs to simulate forest supply dynamics:

a description of the initial state of the forest;

a schedule of desired resource use; and

a set of criteria which determine stand dynamics.

Silvicultural experience in the forest under analysis is essential during forest supply analysis to ensure the biological realism of the supply model. A sound knowledge of the biological responses to intervention for each stand type is crucial; the accuracy of supply forecasts can be no better than the biological realism of the model.

Based on the three information inputs (initial state, resource use/management assumptions, and rules of change) forest supply models simulate stand development and forest dynamics over a long time period, usually in excess of one managed stand rotation. Forest management objectives provide modelling criteria, or indicators for evaluating the achievement of resource supply objectives (quantity, quality, location and timing) over the projection period. Depending on the dynamics of the forest and the nature of forest level objectives, resource supply problems may be detected during supply forecasting.

A resource supply problem occurs when the supply of a specific resource falls short of the level specified in forest level objectives. Supply forecasting provides a means of anticipating supply problems and identifying the need for timely forest management actions. The greatest challenge in forest management is anticipating the need for specific action, at specific times and in specific places.

Resource supply is a function of the initial structure and dynamics of the forest, and the spatial and temporal nature of resource allocation to users. Resource supply problems may result from:

biological factors:

Site productivity directly affects stand growth rate and productivity potential. Site productivity and the silvics of the timber species in the forest results in specific patterns of stand development. These biological factors in turn influence management factors such as the length of regeneration period, the pattern and level of volume production the time required for development of a specific stand condition, and the long run sustainable yield (LRSY) of the forest estate. The biological patterns of disease and insect damage and also affects the short-term supply of timber and specific habitat conditions.

forest structure factors:

The size of the timber production land base of the forest is a major factor affecting LRSY. Also, the distribution of certain stand age classes may affect both timber harvest flow, as well as the availability of critical habitat or biodiversity features or conditions in the forest. The proportion of NSR in the forest affects the short-term timber harvest level, as does the periodic rate of timber losses from fire.

economic factors:

The physical geography of the forest estate strongly influences forest management economics. Inaccessible or economically inoperable stands affect the size of the timber harvesting land base, and hence the LRSY. Past or present circumstances that restrict harvesting to a specific portion of the full forest timber profile may result in future reductions in the harvesting land base, and abrupt reductions in LRSY.

integrated resource objectives:

Integrated resource management objectives affect the area of forest removed from the timber harvesting land base. Allocations for special non-timber uses, whether permanent or temporary, may result in periodic or long term interruptions in timber flow.

forest policy constraints:

Forest practices policies, such as harvesting guidelines designed to protect non-timber values, impose constraints that may result in timber supply problems. Examples of these include:

- opening size and shape restrictions;
- adjacency and exclusion period (green-up) rules;
- maximum percentage of area with stands under the exclusion age;
- minimum percentage of area retained in the larger height classes;
- old-growth reserves;
- protection of riparian zones;
- retention of biodiversity (forest ecosystem networks);
- snag and green tree retention (within-block diversity); and
- visual quality objectives (Nelson 1993).

Other policy constraints that affect timber flows are the maximum permissible rate of declining harvest levels in forests with anticipated timber deficits, and the harvest rules regarding minimum rotation age.

Silvicultural and ecological knowledge and expertise is essential to correctly interpret resource supply forecasts and sensitivity analyses. Supply problems may be insensitive to silvicultural interventions because of the current state and projected dynamics of the forest. In this case, tacit acceptance of impractical or unachievable forest level objectives must be avoided, or forest management will ultimately fail in spite of heavy investments in ineffective interventions.

The foregoing discussion of stand and forest dynamics models is intended to reinforce the importance of these decision support tools to sustainable forest management. Atherton (1998) Suitable stand and forest models should be developed that are capable of forecasting the quantity and quality of timber and non-timber resources and habitat supply. Personnel must be trained in the use of these models, and in the design of management unit strategies.

The utilisation of stand and forest level growth and yield models will significantly reduce uncertainty regarding the future managed production of forest values. This will indirectly aid in maximising multiple benefits to society, a primary goal of sustainable forest management. Other sustainable forest management elements that will likely be enhanced include: biodiversity management, maintenance and enhancement of forest ecosystem condition and productivity, conservation of soil and water resources, and accepting society's responsibility for sustainable development.

In addition to decision support initiatives recommended in this issue, full implementation of the growth and yield recommendations in Issues 8, 9 and 13 are advocated.

Habitat Prediction Modelling and Mapping

Multiple uses and needs for this type of decision support resource have been identified, primarily for landscape and site level planning to meet species habitat needs and to maintain habitat and ecological representation in the landscape. This decision tool is of particular importance for SFM management decisions related to areas such as:

maintenance and enhancement of forest ecosystem condition and productivity;

multiple benefits to society;

accepting society's responsibility for sustainable development;

biodiversity/species diversity management;

managing large scale disturbances such as pest infestations and fire;

species at risk population and habitat management; and

ecosystem resilience and productivity.

In order to improve the success of achieving sustainable forest management, the presentation of data and basic resource information must be clear and complete. Of particular interest, is the presentation of habitat information at the landscape level to support strategic management decisions about balancing development activities and the needs of different habitat-dependant species.

Full implementation of the strategic recommendations relating to development of habitat prediction methods and habitat mapping in Issues 2, 3, 4 and 7 are advocated.

A Community SFM Communications Strategy

The objective of this decision-support strategy is to enable native and non-native communities a means to measure the relative success of SFM objectives documented in procedures, agreements and protocols. The overall goal is to maintain and enhance positive relationships and interactions between forest managers and community stakeholders, and to facilitate informed and effective decision-making and adaptive management skills throughout the region.

The most immediate task to implement this strategy is to establish a cross-sector regional team to design the strategy and tactics required.

Remote Sensing

This decision support tool is a key means to improve the efficiency of inventory, ecological, habitat and pest mapping. A specific application that would be very useful in the short term would be to monitor and update disturbance patterns.

The employ of remote sensing could significantly improve maximising multiple benefits to society, a primary goal of sustainable forest management. Other sustainable forest management elements that could be enhanced include biodiversity management, maintenance and enhancement of forest ecosystem condition and productivity, and accepting society's responsibility for sustainable development.

Implementation of all recommendations contained in Issue 9, Strategy 1 are advocated.

Define Performance Indicators, Targets & Milestones:

Will be addressed as the knowledge activities are undertaken

Describe Relationship to Other SSFM Knowledge Strategies (if applicable):

In addition to the specific linkages indicated above, there are additional broad linkages to all of the other SFM Issues and sub-issues. Other knowledge strategies will identify specific management questions, challenges, knowledge gaps and activities to fill these gaps. The management decisions and challenges may require the strengthening of or development of a new decision support tools.

Specific strategies, tactics and projects/activities must be staged over time due to constraints associated with logistics, capacity, investment costs and the products of one activity supporting the initiation or completion of another activity.

Cross Reference to Management Unit Activities (when complete):

Strategy 1: Watershed Management Decision Support

Tactic 1	Watershed Sensitivity Analysis

Tactical Summary:

Currently there is little or no basic watershed management information available that is organised or synthesised so that a decision-maker might readily access and use it. The absence of this information constrains every other land management decision, due to the interdependence between water and all other elements of sustainable forest management.

Watershed sensitivity analyses need to be completed for the region, but this knowledge strategy recommends beginning with high priority watersheds and management units. When prioritising areas for this work, the level of existing cumulative development, planned development anticipated and known or suspected watershed sensitivities (e.g. sensitive fish species and habitats, community uses, terrain hazards, soil instabilities) must be considered.

One of the primary tasks is to establish which management units are of a high priority and what level of information already exists.

Once the region's watersheds have been prioritised for watershed sensitivity analysis then a work plan for completing these analyses for the region needs to be determined and an implementation plan for the project undertaken including the tasks listed below.

Status:

In most of the region's management units, these are new knowledge activities. New basic data and new knowledge activities must be undertaken.

Some work has been done in isolated watersheds around the region, such as the Stuart-Takla Fish Forestry project and in the Baptiste, Herrick, Bowron and Goat watersheds. The applicability and completeness must be evaluated.

Tactical Objectives:

This decision-support strategy is proposed to provide basic watershed management information in an organised and synthesised format to enable decision-makers to anticipate the relationship between their management decisions for forest activities and the watersheds in which these activities will occur.

Currently, the absence of this information constrains every other land management decision, due to the interdependence between water and all other elements of sustainable forest management. Consequently, this strategy will benefit most SFM decisions including: biodiversity management, maintenance and enhancement of forest ecosystem condition and productivity, conservation of soil and water resources, forest ecosystem contributions to global ecological cycles, multiple benefits to society and accepting society's responsibility for sustainable development. In particular, uncertainties associated with management decision related to sensitive fish species and their habitats, community water uses, and soil and terrain hazards and sensitivities will be reduced.

The completion of watershed sensitivity analysis for the region will largely require the collection and synthesis of new data, but an initial evaluation of the availability and reliability of existing information may be fruitful.

Describe Tasks, Deliverables, Targets and Milestones (Tactical):

This knowledge strategy should be implemented in 20 watersheds over 5 years.

Define watershed parameters (Flow, Chemistry, Temperature gradient, sensitivity, Turbidity, Biotic richness and diversity, Riparian classifications)

Gap analysis to determine where plots are required using VRI standards

Identify sampling matrix

Establish a sampling plan for the region

Evaluate costs/ benefits – leads to implementation

Report

Extension of knowledge

Costs are estimated at $100,000 to $150,000/watershed.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		500 000	500 000	500 000	500 000	500 000	2 500 000	5

Strategy 2: Risk Management Decision Support

Tactic 1	Risk Management Decision Model Development

Tactical Summary:

To improve the success of achieving sustainable forest management through managing risks associated with forest management we must improve our decision support tools to evaluate the relative risk of different management decisions and scenarios.

Risk assessment methods will differ depending upon the particular management decision or scenario that we are evaluating and the land base upon which the evaluation is being undertaken.

Investments in risk assessments for silviculture and stream activities should be undertaken as a priority. Risks associated with riparian and stream crossing management have become a concern and an increasing number of regenerated stands are approaching their late free growing dates, the backlog silviculture program continues to be implemented and pressures for silviculture investments increase with the need to regenerate stands in beetle infested areas.

Status:

While risk assessment models may have been developed for individual forest management elements, this strategy is new for the Omineca-Peace Region.

Tactical Objectives:

Completion of this decision support strategy will assist managers to more judiciously allocate limited operational resources and dollars so that the return on investments can be maximised and significant risks to timber and other forest values can be avoided.

The introduction of risk assessment in silviculture management and stream management decision-making will significantly improve elements of sustainable forest management related to: biodiversity management, maintenance and enhancement of forest ecosystem condition and productivity, conservation of soil and water resources, multiple benefits to society and accepting society's responsibility for sustainable development.

In particular, uncertainties associated with the management of disturbances and stress, soil and water quality, species diversity, ecosystem resilience, biomass and ecosystem productivity, forestland conversion, productive capacity of the economy, contributions to the economy, and supporting forest communities can be reduced.

Describe Tasks, Deliverables, Targets and Milestones:

The knowledge strategy should be undertaken for 10 resource management risks over the next 5 years, in addition to those advocated in other issues and strategies. Initially 4 risk management decision support projects should be initiated in year 1, followed by an addition of 2 projects in each of the remaining years.

Determine risk management decision support issues to be risk modelled e.g. Silviculture treatments, Watersheds – prescriptions for streams, roads, restorations

Identify criteria for each risk assessment category

Cost/benefit analysis to evaluate the utility of running individual risk assessments

Prioritise risk assessment projects

Implement

Report

Extension

Costs are estimated at approximately $80,000/project Development period – 1 year/project								
Cost Sharing:								
Partnerships:								
Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		320 000	160 000	160 000	160 000	160 000	960 000	5

Strategy 3: Tree Growth & Stand and Forest Dynamics Decision Support

Tactic 1	Tree Growth and Stand & Forest Dynamics Decision Support – Problem Analysis

Tactical Summary:

A problem analysis is recommended to evaluate the need for specific stand and forest decision support models and systems. This tactic will result in recommendations concerning the suitability of existing models, and the need for improved versions or new designs.

Status:

Stand and forest models are available for use. Limitations in their design prevent their use in all applications in the Omineca-Peace Region.

Tactical Objectives:

Undertake a problem analysis and review of tree, stand and forest level models for use in timber and non-timber resource supply projection.

Describe Tasks, Deliverables, Targets and Milestones (Tactical):

Conduct review of existing systems and analysis of current and future decision support needs.

Recommend a course of action to make available a suite of suitable decision support models within 5 years.

Year 1 - $35,000 for 6 management units for task #1

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		35 000						1

Tactic 2	Tree Growth & Stand and Forest Dynamics Model Development

Tactical Summary:

Based on recommendations from Tactic 1, undertake the research and development required to develop the necessary suite of models within five years.

Status:

New

Tactical Objectives:

To develop a suite of decision support models and systems suitable for use in the stands and forests of the Omineca-Peace Region within five years.

Describe Tasks, Deliverables, Targets and Milestones (Tactical):

To be determined in Tactic 1.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			250 000	500 000	250 000	250 000	1 250 000	4

Strategy 4: Community Sustainable Forest Management Decision Support

Tactic 1 | Community SFM Communication

Summary:

A number of more detailed tasks and workplans must be developed to ensure this decision support strategy is designed for the needs of local communities in the Omineca-Peace Region The most important task is to establish the cross-sector regional design team to oversee the development of the activities and tasks and to monitor the success and adapt where necessary.

Status:

A number of communications strategies have been undertaken associated with planning initiatives such as certification programs and strategic planning processes. This activity encourages an ongoing and co-ordinated dialogue and as such, this activity is off strategy.

Objectives:

The objective of this knowledge activity is to measure the success of achieving objectives set out in procedures, agreements and protocols on aboriginal involvement in resource management and to measure the success of achieving the region's native and non-native communities' resource related objectives. The goal is to maintain and enhance positive relationships and interactions between forestry and stakeholders and to advance informed and effective decision-making in the region.

Describe Tasks, Deliverables, Targets and Milestones:

Establish a collaborative, cross-sector regional design team to oversee this activity and to establish more detailed tasks and workplans to address this knowledge activity.

Establish a strategy to monitor the achievement LRMP objectives and other SFM planning initiatives (i.e. LUP)

Establish an effective communications strategy that address local audience needs and issues

Produce communications products to support communications strategy (i.e. spatial modelling)

Costs are anticipated to be $25,000 per District per year

Cost Sharing:

Partnerships:

A number of partnerships that already exist that facilitate the communication if SFM information (i.e NFPA Community partnership agreements, LRMP monitoring tables). Organisations that might also take an active interest in this activity include (but are not limited to): the Northern Forest Research Extension Partnership; Village Councils; and Canadian Women in Timber.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		250 000	250 000	250 000	250 000	250 000	1 250 000	5

Strategy 5: Remote Sensing Decision Support

Tactic 1	Remote Sensing Research and Development

Summary:

The key task to addressing this decision support need is to identify potential remote sensing applications for sustainable forest management and then to assess the value of their application in particular decision-making situations relative to other more conventional, less costly analysis and decision support tools.

The need for implementing this tactic in any management unit will depend largely upon available remote sensing applications and the particular management decision that requires support. At this time, specific attention should be given to evaluating the costs and benefits of using remote sensing in managing beetle infestation areas.

Status:

Largely a new activity, very little remote sensing work and application has been tested or undertaken in the region.

Objectives:

This decision support knowledge activity has been proposed as a means for strengthening inventory and ecological and habitat mapping and beetle infestation predictions. A specific application that would be very useful in the short term would be to monitor and update disturbance patterns.

The employ of remote sensing could significantly improve maximising multiple benefits to society, a primary goal of sustainable forest management. Other sustainable forest management elements that could be enhanced include biodiversity management, maintenance and enhancement of forest ecosystem condition and productivity, and accepting society's responsibility for sustainable development.

In particular, uncertainties associated with the management of disturbances and stress, ecosystem resilience, ecosystem productivity, forestland conversion, productive capacity of the economy, contributions to the economy, and supporting forest communities can be reduced.

Describe Tasks, Deliverables, Targets and Milestones:

Perform a gap analysis to determine what remote sensing applications have been tested and identify projects that are close to being operationally feasible – these projects may include but not limited to:

Updating disturbances;

Predicting beetle and other pest and disease infestation patterns;

Strengthening inventory;

Enhancing habitat mapping;

Perform a cost/benefit analysis to determine which applications might be useful in the short term; and

Undertake to complete the remote sensing projects that can make a positive management decision-making contribution.

Cost Sharing:

Partnerships:								
Investment to date		Investment Required - unknown						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		200 000	200 000	100 000	100 000	100 000	700 000	5

ISSUE 7: INADEQUATE FISH AND FISH HABITAT MANAGEMENT OBJECTIVES

Overview Description of the Regional Strategic Issue:

In the Omineca-Peace Region large areas of the land base lack fisheries information and much of the existing information is under-utilised by stakeholders. These are significant constraints to the development of both operational and strategic resource planning. Improving the reliability, completeness and consolidation of fish information will enhance the ability to establish clear and measurable management objectives for sustainable fisheries management today and enable the monitoring and adaptation of the management objectives in the future.

Relationship to Sustainable Forest Management:

The Maintenance of Environmental Values:

General populations of fish and fish habitat are potentially at risk from human activities that affect their habitat (i.e. access, food supply, water quality etc.). Increased fisheries knowledge will help decision-makers conserve biological diversity and facilitate the achievement of forest certification by licensees. More complete knowledge of fish forestry interactions and aquatic ecosystem dynamics will give us the information to manage more effectively across the variety of ecosystems in the region and refine standard operating procedures (SOPs), such as. timing windows and measures, to management units or to watershed level where appropriate. Knowledge of fish distribution and fish habitat will ensure that appropriate riparian management practices and road development are planned for and implemented. Increased fish distribution knowledge will also target populations of 'identified wildlife' (bull trout and potentially arctic grayling) for consideration under the Forest Practices Code Identified Wildlife Management Strategy. (This links to SSFM Issue # 3: Lack of species at risk management objectives). Filling these knowledge gaps and making data more accessible to resource planners and users would substantially improve decision making by introducing more certain and complete basic information/data, enable the development of management options and empower a much more accurate evaluation of the implications of management decisions.

Thus work is needed in the following general areas:

- Fish inventory
- Data management
- Predictive modelling
- Research
- Extension

The Sustainability of Timber Resources:

The most significant timber supply related risks and uncertainties exist in the following areas:

- Riparian area management requirements
- Absence or presence of fish and accurate stream classifications
- Stream crossing structure planning, installation, maintenance and deactivation
- Soil and water quality management
- Road access
- Timing windows and measures

Defaulted fish bearing stream classifications assigned in lieu of accurate fish distribution information can cause the unnecessary retention of timber and higher development costs when non-fish-bearing streams are managed as fish bearing. More fish distribution knowledge will decrease uncertainties in the timber supply, contribute to more effective forest development planning and potentially reduce development costs.

The Sustainable Use of Non-timber Resources:

The most significant risks and uncertainties for sustainable use of the fish resource that might be impacted by forestry/ fish interactions relate to:

- First Nations
- Recreationists
- Tourists
- Angling Guides
- Commercial Fisheries

Fisheries information is used to establish current management practices for the freshwater fisheries resources in the Region. Accurate and complete information is needed to set sport and commercial catch limits, manage aboriginal fisheries and contribute to treaty negotiations, plan access management for non timber resource use, as well as to maintain other forest values (i.e. viewscape, water quality) so that fisheries resources remain healthy and sustainable.

Relationship to Strategic Resource Plans and Decisions:

Strategic Decisions:

Completing basic fisheries distribution information through data collection or modelling (as supported by recent changes to Forest Practices Code of BC Act OPR 15(2)) will directly improve upcoming timber supply review decisions by providing insight into potential withdrawals from or additions to the availability of timber by identifying. riparian area management requirements and stream crossing locations and structures. Under OPR 15(2) streams may be assigned riparian classes based on available data about the stream, without the necessity of field observation. More knowledge of aquatic ecosystem dynamics will identify sensitive streams and fish populations and their impact to the timber supply (i.e. limitations on road access, Identified Wildlife Management Strategy (Issue #3), implementation of best management practices etc).

Strategic Resource Plans:

Most of the Omineca-Peace LRMPs give general and specific direction on fish management; some plans recommend the expansion of fishing related recreation and tourism opportunities; some caution against access related impacts to sensitive fisheries; some make recommendations for forestry activities due to anticipated impacts on fish and fish habitat. The implementation of LRMP direction on fish and fish habitat is currently hampered by the inadequacy of basic information on the distribution of certain species, the lack of information on the sensitivities of fish populations and the lack of analysis of existing data to inform management decisions.

The development and implementation of other plans, policies and procedures (i.e. TWM, Guidebooks, DM policies, SOP's, SFM Plans, LUP, IWMS, IFPA's) will be better informed and managers will be better able to monitor and adapt their management as appropriate.

TSR II is currently fully underway in the Omineca-Peace Region. With the completion of the Mackenzie LRMP in 2000, all LRMPs in the Omineca-Peace Region are now being implemented. The other strategic plan initiatives listed are currently either under development or are being implemented – the knowledge strategies are relevant now for plan development and monitoring and their value will increase over time.

Cross Reference to Management Unit Issues:

There will be a need to recognise unique management unit knowledge needs due to fisheries variation across the region. The need for management unit specific knowledge will be identified through the prioritisation of knowledge gathering activities at a scale that is appropriate for addressing the management concern.

Status of Existing Knowledge:

Organisation, synthesis and analysis:

A provincial fisheries data warehouse contains various oracle tables and tools which can be queried, many of them over the internet, (i.e. Fisheries Information Summary System (FISS), lake survey data, stocking records, watershed dictionary, Fish Wizard, Fish Habitat Inventory Information Program (FHIIP) data).

All fisheries data is incorporated into the data warehouse at a summary level (FISS) and reconnaissance inventory data is also loaded into various oracle tables. High investments in Omineca Peace fish inventory in recent years and limited resources have constrained (1) the delivery and (2) loading of data to provincial databases resulting in a lag time in the updates (it is important that headquarters receive adequate support to address this backlog).

Completed projects are posted locally on the regional website, but are probably unknown to many stakeholders (i.e. licensee planners). These reports contain individual, uniquely formatted databases that cannot be easily queried or used at a strategic level. At present there are no local products that summarise regional information for our user community, although this need has been clearly identified. To this end regional procedures are being developed to summarise both complete (provincial warehouse) and incomplete (only locally available) reconnaissance inventory data, so they may be used to together generate regional coverages, conduct gap analyses and strategic planning etc.

The Fisheries Project Registry (FPR) is an internet-based, map-linked index of all fisheries projects in

BC. There is a time lag in providing regional updates to the FPR as new projects come on line each fiscal year.

Provincial Resource Inventory Committee (RIC) standards and tools exist for the collection and predictive modelling of fish habitat and distribution (i.e. FDIS, RIC manuals, FHAT 20).

Predictive modelling (FHAT 20) is currently being tested by Ministry headquarters researchers on two watersheds in the region and some licensee pilots are anticipated in 2001/02. There is industry interest in expanding this activity. FHAT 20 modelling is based on 1:20,000 scale data and works best in conjunction with the TRIM (1:20K) watershed atlas, however many watershed units where modelling is desired do not have the TWA available. Older data sets will have to be upgraded to FDIS 6.5 or beyond to be used in FHAT 20, and in areas where existing data is not contiguous across watersheds, a phase 1-3 1:20k inventory is required prior to using the model.

Two licensees have developed simple fish presence/absence models for use in Local Area Agreements (LAA) to satisfy operational inventory needs.

Large-scale modelling at the forest district level (i.e. Arrow FD) is also being piloted through IFPA initiatives developed in conjunction with Sustainable Resource Management headquarters staff.

There is a substantial amount operational fish inventory data collected by licensees that has not been made available to provincial databases or other stakeholders. Many of these data exist in non-standard formats and may not be digital or geo-referenced, but it is desirable to add this information to our corporate data.

Inventory:

Reconnaissance fish and fish habitat inventory is available for <30% of the Omineca-Peace; there are still large areas to be addressed.

Overview (1:50k) inventory has been done on 8 watersheds in the Peace and 1 watershed in the Omineca, but there are additional areas in the northern parts of the region where overview inventory is needed to provide basic fisheries information and direct priority setting for future work.

Species and inventory that would provide life history information across the range of ecosystems in the region is lacking for most areas.

Some population inventory is underway by various agencies/initiatives. Most of these are directed at populations of species at risk (RMP issue #3).

Aerial videography habitat inventory has been done in major watersheds in the Mackenzie and Robson Valley planning units and is available as a digital coverage of habitat units and features.

Licensee operational inventory (fish stream identification and stream classification) is ongoing.

Extension:

It has become apparent that many stakeholders are unaware of (or unskilled at using) digital search tools that provide fisheries information to the resource community. In other cases the perception exists that these tools are inadequate to meet user group needs. The communication of extension information is by various methods (email announcement, internet communication, scheduled workshops, and ongoing headquarters support as needed), but it appears the information is not effectively reaching all potential users.

Research:

There is a body of research on fish/forestry interactions and aquatic ecosystem dynamics, but much of it is based on coastal or other, non-local ecosystems and many questions are still unanswered. Stakeholders are not always aware of ongoing research projects and their potential relevance to the forest industry.

Monitoring:

There are 3 Local Area Agreements for fish stream classification in place with various licensees, but to our knowledge, only one of these (Fort Nelson) has received limited monitoring. More monitoring is desirable and will facilitate more informed decision-making and management adaptation.

Recommended Knowledge Solution:

General Approach:

The knowledge solution requires more effective use of existing information, and the collection of new information. This may be accomplished by:

- Consolidating fish and fish habitat information;
- Completing fish and fish habitat inventories;
- Understanding impacts of development activities on aquatic ecosystems;
- Understanding aquatic ecosystem dynamics;
- Adapting the existing extension delivery to meet regional needs ;
- Using fish habitat prediction models;
- Providing a regionally adapted fish and fish habitat inventory information system.

Consolidating information, adapting extension delivery and establishing a regional information system are all solutions that improve the utility of existing information by increasing its availability to all regional stakeholders. Fish habitat prediction modelling and improve understanding of aquatic ecosystems require the use of existing knowledge as well as the gathering of new information. Completion of fish and fish habitat inventories requires collecting new information.

These solutions will address information and knowledge gaps and significantly improve our ability to develop management scenarios, make informed management decisions, enable the monitoring and adaptation of management decisions and assess the risk associated with management activities and decisions.

Specific Solutions:

The recommended solution employs four integrated knowledge strategies:

Regional Fisheries Information Management;
Fish and Fish Habitat Inventory and Mapping; and
Aquatic Ecosystems Research; and
Aquatic and Riparian Ecosystem Management

Strategic Performance Indicators, Targets & Milestones:

Strategic performance indicators vary by strategy. Specific information is provided in Tactical descriptions.

Relationship to other SSFM Knowledge Strategies:

There are linkages to the following other knowledge strategies:

Incomplete or inadequate inventory information
Species At Risk Management Objectives
General Wildlife Habitat Management objective
SFM Decision Support Tools
Visual Sensitivity (for recreational and tourism uses)
Alternative Harvesting Techniques

Activities must be staged over time due to constraints associated with logistics, capacity and investment costs as well as the need to integrate products across a number of the knowledge activities.

Strategy 1: Regional Fisheries Information Management

Tactic 1	Fish and Fish Habitat Data and Information Consolidation

Status of Knowledge:

Although provincial data warehouses and project listing summaries are well-developed and useful tools for accessing fisheries information they are not up to date with respect Omineca-Peace Region information due the large volume of information recently collected and inadequate resourcing to handle it. Delays occur both in providing information to headquarters and in processing by headquarters. An up-to-date catalogue of tools, applications, listings etc. that captures all available fish and fish habitat information for the region and is accessible for end-user groups is needed, preferably in a "one-stop-shop" location. A regional webpage would serve this function, where users are informed about various sources of information and can link directly to them. To ensure the information is up-to-date, this exercise will identify any information not previously captured, evaluate its relevance and forward it to the appropriate information warehousing applications (FISS, FPR, FDIS etc.). It is expected that much of the information will come from various licensee in-house projects. Information that does not 'fall' into an existing application may require a separate application or listing. The outcome of this exercise will be a fundamental building block for the rest of the activities in the knowledge strategy as an information support.

It is critical that this catalogue be updated on an annual basis. Ongoing investments need to be made to ensure that the initial investment is not wasted and so that the catalogue continues to be relevant and useable. Although information will be collected locally, support will be required for headquarters staff to incorporate the information into the appropriate applications in a timely manner. The standardisation of the information needs to be sensitive to existing needs and capacity. Ideally, information should be geo-referenced to account for different clients' administrative boundaries (e.g. LU, traditional territory, RMZ, District, Operating area, guide territory, etc.).

Tactical Summary:

Provide an up-to-date catalogue of available and relevant fish and fish habitat information for the region that is appropriate and accessible for end user-groups. This exercise will identify any information not previously captured, evaluate its relevance and forward it to the appropriate information warehousing applications (FISS, FPR, FDIS etc.). It is expected that much of the information will come from various licensee in-house projects.

It is important that backlogged information be made available to the different warehouse applications for user access efficiency. Support for this task is required at both provincial and regional levels.

The catalogue must be updated on an annual basis. Ongoing information consolidation investments need to be made to ensure that the initial investment is not wasted and so that the catalogue continues to be relevant and useable. The standardisation of the information needs to be sensitive to existing needs and capacity.

Status:

Fisheries information is presently summarised and identified in various provincial applications i.e. Fisheries Project Registry, FISS, fisheries data warehouse etc. This activity would build on existing efforts by identifying and forwarding new or previously uncaptured information to the appropriate corporate information system. Information that does not 'fall' into an existing application may require a separate application or listing.

Tactical Objectives:

The objective is to compile, catalogue and store the most up-to-date data and information regarding fish and fish habitat knowledge activities in the region. Thus this activity is the fundamental information building block for the overall knowledge strategy. This activity is high priority in the first two years until the information catalogue is current, priority drops as it becomes a maintenance function Secondary objectives that follow from this activity are:

- to complete a gap analysis that will identify the needs for additional knowledge gathering activity
- to support the development of a reconnaissance inventory information system for the region.

This activity should be considered a priority during the first two years of implementation of the overall knowledge strategy, or until the information summary is current. This activity should then occupy a lower priority within the overall strategy, as it becomes a maintenance function.

Tasks, Deliverables, Targets and Milestones (Tactical):

Complete the information consolidation within the first two investment years.

- $135K for the entire region for the first two years' development and updating costs, based on funding co-op students in both region and headquarters,

- $15,000 per year for ongoing maintenance and updating

Determine what existing information is known to the user community via existing applications (FISS, FDIS, FPR etc.) and what remains to be updated by headquarters.

Establish mutually agreeable timelines for outstanding updating required.

Gather and catalogue existing information for completed and uncompleted projects that are not known in existing information applications

Determine criteria for evaluating the information and determine information/data requirements for integration into existing applications or requirements for a new application.

Evaluate information and take appropriate action i.e. send to FISS, enter into FDIS, list in FPR etc.

Perform gap analysis to determine what additional information must be gathered

Final consolidation of the information and communication/feedback with headquarters

Report and summary on regional website: one-stop-shop will provide an overview of all regional information available and its status, with links to the provincial warehouse applications (and later the regional information system) where users can obtain the actual detail.

Extension – ties in to Tactic 2 (Regional Fish and Fish Habitat Data Management System) and Tactic 3 (Fisheries Extension Program).

Maintain and update the information catalogue on a periodic basis.

Cost Sharing:

Updating of fisheries information is ongoing by Sustainable Resource Management headquarters. A critical component to the success of a regional information catalogue is having the region provide information to head quarters and then timely integration of this information to various corporate applications. Headquarters must receive adequate support to maintain and update corporate information systems.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		75 000	60 000	15 000	15 000	15 000	180 000	5+

Tactic 2	Regional Fisheries Information System Development

Status of Knowledge:

Regional users (both internal and external) require a flexible, accessible and useable information system that would provide all regional fisheries reconnaissance data available. This should be a regionally adapted version of the provincially developed/ housed data system but would include data for both complete and incomplete projects. The information system should provide:

- a digital, geo-referenced consolidation of all reconnaissance fish and fish habitat inventory for the region;

- a web-based view and point functionality for user-coverage downloading.

- a fisheries data attribute/column that bookmarks additional analysis derived information sources (like LAAs, IM's, HLP's, TWM, RMZ direction, stream classification; FHAT 20 results); and

- full integration of all existing operational inventory datasets. Differences in the data collection standards, compatibility of database structures, product quality assurance etc. between operational and standard reconnaissance data need to be evaluated in order to determine how to best incorporate/utilise the operational data.

Key design considerations include:

the establishment of a collaborative (agency, industry, end-user) design team to assess users' needs and inform the design of the system;

the need to actively maintain the tool to extend its useful life;

resolution of variable data accuracy standards, data definitions, and database structure associated with existing operational, licensee and standard reconnaissance data sets;

the potential for application of this tool elsewhere in the province; and

design flexibility that will allow adaptation for changing data variables and formats for future predictive model development.

Tactical Summary:

This tactic is designed to provide up to date regional inventory information via a flexible, accessible and useable information system that meets the needs of a variety of user groups. This tool will also provide a significant support for ongoing training and extension activities identified as a separate knowledge activity and as a task under each of the knowledge activities in the overall strategy, as well as form a component of activity 1.

This activity is dependent upon the status of the consolidation work and also the filling of identified information gaps using the inventory completion activity. The product of this activity will support the predictive modelling activity – thus requires flexibility in its design to accommodate modelling information needs (information formatting as predictive model information needs are identified).

While working collaboratively on this tool, ongoing roles and responsibilities for managing and maintaining this inventory information repository should also be identified – ongoing maintenance and continuous updating is a key element of this knowledge activity.

Status:

This activity is largely reliant upon existing work done by headquarters, but will also require new work in the region to meet the full suite of end-users' needs. Some work has been done regionally to develop procedures to load and query reconnaissance inventory data to provide regional data products.

Tactical Objectives:

To develop and implement a regionally adapted fish and fish habitat inventory information system;

To define and assign appropriate data management responsibilities amongst users of the information and government agencies.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development Costs – software and system design, information input $200,000 over first two years.

Maintenance and update, hardware and support costs – $50 K per year (person and equipment).

Establish a collaborative (agency, industry, end-user) design team

Perform a needs assessment: e.g. canvass what are end users' needs

Co-ordinate tasks and information base development with ongoing headquarters activities to avoid duplication of effort.

Assess existing information systems – evaluate the use and/or adaptation of an existing system to meet the need

Design and construct the framework – define roles and responsibilities associated with custodian, maintenance, data input and update

Establish the information base (including data entry and loading) using the information generated from the information consolidation knowledge activity

Implement

Develop and implement end-user tools based upon an evaluation of audience needs

Training and extension

Maintain and update the information base and the information system periodically

A regional information system should be online by 2004 or 2005, and will require subsequent to ongoing updating and maintenance after that

Cost Sharing:

Much of the information base for this system will be provided from corporate data that is updated on an ongoing basis by Sustainable Resource Management headquarters. To avoid duplication of effort the regional system will focus on adding additional data and information from incomplete projects to the information base. However, it will be important to address the incorporation of unloaded data that is backlogged at headquarters so it can be added to the regional system. The intent of this activity is to build on existing information available in corporate dbases; headquarters must receive adequate support to maintain and update corporate information systems.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	50 000	50 000	50 000		5+

Tactic 3	Regional Fisheries Extension Program

Status of Knowledge:

It has become apparent that many stakeholders are unaware of (or unskilled at using) digital search tools that provide fisheries information to the resource community. In other cases the perception exists that these tools are inadequate to meet user group needs. The communication of extension information is by various methods (email announcement, internet communication, scheduled workshops, and ongoing headquarters support as needed), but it appears the information is not effectively reaching all potential users.

Improving the utility of fisheries data, information and knowledge requires that the user community is aware of the existing knowledge resources and tools and that new knowledge and tools originating from other strategies are conveyed in a timely and consistent manner.

The regional information catalogue and information system represents the resources and tools available. A well-designed and locally adapted fisheries extension program should be implemented to maximise the benefit of these knowledge resources. An extension program initiative will increase managers' and practitioners' ability to make informed and effective management decisions, will lead to the evaluation of the knowledge gaps, the knowledge products and the management decisions being made as a result of these.

Tactical Summary:

This knowledge tactic will yield a regionally responsive fisheries extension program that builds on existing extension delivery and delivers timely and effective information to end-users as needed. Extension delivery is a necessary element of the adaptive management cycle and of the sustainable forest management endeavour in this region.

The cornerstone of this initiative is to engage a regional design team to adapt the existing extension strategy, with extension delivery occurring at both the local and regional level. The regional design team needs to be representative of the geography of the region and needs to ensure that extension delivery effectively engages people from all corner of the region.

The identified audience will primarily be practitioners and technicians; however, this does not limit the expansion of any particular extension activity to an audience that includes other interested or affected groups.

Status:

Traditionally, extension activities have been conducted on an ad hoc basis, with little co-ordination beyond an individual program and rare follow-up after the extension delivery to gauge participants' success at understanding and assimilating new knowledge. As such, the establishment of a regional design team for fisheries extension and the ongoing development and delivery of extension activities is new.

Tactical Objectives:

To maximise the effective use of existing knowledge, and in so doing, to promote informed and effective decision-making by resource practitioners and managers in the region by facilitating the ongoing review of knowledge gaps, the evaluation of available knowledge products and the identification of new knowledge activities and strategies.

Tactic 1 (Information Consolidation) and 2 (Information System Development) will be contributing initiatives linked with this tactic.

Tasks, Deliverables, Targets and Milestones (Tactical):

Establish a collaborative (agency, industry, end-user) design team to implement this tactic.

Identify existing extension organisations and forums.

Assess existing extension delivery and identify audiences and user groups and their needs.

Develop a suitable delivery model.

Set up a mentoring approach to extension activities

Provide ongoing fisheries information exchange and tool-use forum and co-ordinate these activities with ongoing Sustainable Resource Management headquarters extension efforts

Address combined delivery of extension, monitoring and maintenance activities identified in Strategies 2 and 3 (Fish and Fish Habitat Inventory and Mapping; and Aquatic Ecosystem Research)

Develop Webster, PDF conversion, facilitating, annual discussion forum, co-ordinating partners' input, extension notes.

Cost Sharing:

Sustainable Resource Management headquarters staff provide most of the existing extension delivery. They conduct ongoing development of tools and data systems, and provide ongoing user support. Work under this activity would be co-ordinated with, and build on, their efforts.

Partnerships:

While Provincial and Federal Agencies responsible for fish and fish habitat management and sustainable forest management mandates currently provide extension services other groups that might be interested in partnering on this activity include (but are not limited to):

- Northern Forest Research Extension Partnership
- UNBC

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		75 000	50 000	50 000	50 000	50 000	275 000	5+

Strategy 2: Fish and Fish Habitat Inventory and Mapping	
Tactic 1	Regional Fish and Fish Habitat Inventories

Status of Knowledge:

Reconnaissance fish and fish habitat inventory is available for <30% of the Omineca-Peace; there are still large areas to be addressed.

Overview (1:50k) inventory has been done on 8 watersheds in the Peace and 1 watershed in the Omineca, but there are additional areas in the northern parts of the region where overview inventory is needed to provide basic fisheries information and direct priority setting for future work.

Species population and habitat inventory that would provide life history information across the range of ecosystems in the region is lacking for most areas.

Some population inventory is underway by various agencies/initiatives. Most of these are directed at populations of species at risk (RMP issue #3).

Aerial videography habitat inventory has been done in major watersheds in the Mackenzie and Robson Valley planning units and is available as a digital coverage of habitat units and features.

Licensee operational inventory (fish stream identification and stream classification) is ongoing. There are 3 Local Area Agreements for fish stream classification in place with various licensees, but to our knowledge, only one of these (Fort Nelson) has received limited monitoring. More monitoring is desirable and will facilitate more informed decision-making and management adaptation.

Tactical Summary:

Overview, reconnaissance, life history, and population inventory information needs to be completed for priority watersheds throughout the region. Initially, more inventory work will likely have to be undertaken in northern management units and in heavy beetle harvest areas.

Ultimately, however, the prioritisation and correct identification of inventory needs will be key aspects of the overall success of the Inventory and Mapping Strategy. The sensitivity of the watershed and its fish species, and the cumulative and planned development and direction from other resource plans need to be considered. Prioritisation criteria should also consider other recommended strategic and tactical fisheries initiatives.

Overview inventory is needed in the Fort St James and Mackenzie Forest Districts, and all districts in the Peace. Gaps in reconnaissance inventory exist in all forest districts but are largest in Fort St James, Mackenzie and Robson Valley. Life history information is needed for various fish species/populations across the region, particularly those in northern latitudes. The information gathered from these activities would feed into the regional information catalogue and information system, support strategic planning and predictive modelling, and enable the refinement of SOPs, resulting in more effective fisheries management.

The results of this tactic may indicate a need for further, more detailed inventories.

Status:

Ongoing - work has already been undertaken throughout the region.

Tactical Objectives:

To collect compile new, basic fisheries information to support other knowledge strategies and tactics within this RMP (all tactics of the Regional Fisheries Information Management Strategy, and the Regional Fish and Fish Habitat Prediction Model Development Tactic of this strategy).

The ability to effectively develop and use advanced analysis and decision-making tools is currently limited by a lack of basic information inputs in some geographical areas and for some aquatic parameters and species.

Tasks, Deliverables, Targets and Milestones (Tactical):

The principle tasks comprising this tactic are:

Using gap analysis from data consolidation activity, identify watersheds requiring further inventory data collection and the type of inventory that is most appropriate (reconnaissance, species, overview, population etc.);

Establish criteria for evaluating the priority status or watersheds and identifying priority watersheds;

Prioritise watershed requiring further work (based upon watershed sensitivity, existing and planned development, others);

Conduct field inventory;

Integrate this information into the information summary, information system and modelling products;

Report and Extension; and

Update the fisheries information catalogue and information system and re-evaluate gap analysis

Tasks and Costs:

$60– 200 K per year per watershed, depending on the kind of inventory and access to the watershed.

Other inventories as identified by stakeholders: 5K-100 K per project (i.e. species inventory, life history studies, population monitoring).

An average of 1-2 watersheds per District per year as a target; anticipate covering northern areas, beetle harvest areas and priority areas where less information has been gathered in the first several years, so inventory effort may not be evenly distributed between management units in the first several years. As predictive modelling is utilised field inventory requirements and thus costs are expected to decrease over time.

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		1 250 000	1 250 000	1 250 000	1 000 000	1 000 000	5 750 000	5+

Tactic 2	Regional Fish and Fish Habitat Prediction Model Development

Status of Knowledge:

The use of predictive models to determine fish distribution and habitat capability in un-sampled areas will greatly enhance fisheries management and strategic planning over the landbase. Inventory costs will be reduced and the risk associated with predictions can be measured thereby reducing uncertainties associated with management decisions. Standard queries could be established as a function of the models employed or may be an element of the regional information system.

FHAT = Fish Habitat Assessment Tool. The 1:20,000 Reconnaissance Inventory and FHAT20 were developed to allow more efficient sampling of a watershed, and provide a standardised procedure for extrapolating this data to the whole watershed. FHAT will predict the probability of presence of fish in a certain type of reach and some of the reaches habitat characteristics (i.e. predicted width, probability that a definable channel is present, etc.) It then assigns levels of confidence around the estimates.

Fish distribution and channel widths predicted from FHAT20 Model results can be applied to Forest Practices Code stream classification under a Local Area Agreement. At the FDP level, information available through a Reconnaissance Inventory and FHAT20 is directly applicable to fish-stream identification because it identifies known and probable areas of fish presence and absence at a 1:20,000 scale. This information identifies where the probability of fish presence is low, or where fish-bearing status is uncertain. This methodology thus identifies areas of uncertainty where further sampling can be focused economically to determine fish-bearing status as required.

Analysis of data for development of LAAs will build on and enhance the value of 1:20,000 Reconnaissance work.

A key task will be to ensure that data is formatted appropriately for input to predictive models (i.e. complete phase 1-3 reconnaissance inventory, new inventory and TRIM watershed atlas) – this will require related project investments.

Predictive model outputs will form a component of both the regional information consolidation and the regional information system.

Tactical Summary:

This tactic is designed to evaluate the effectiveness of the existing FHAT 20 model in predicting fish distribution and stream classification for strategic planning purposes in various regional watersheds. This results of this evaluation will become important due to recent changes to the Forest Practices Code Act of BC, operational planning regulation 15(2) which permits stream classification based on available data, without the necessity of field observation. Use of FHAT 20 will determine if there is a need to refine it, or alternatively, develop and test other models.

Key elements of this knowledge tactic include:

performing a comprehensive needs assessment at the outset;

testing and evaluating the existing FHAT 20 model;

identifying areas for field inventory;

determining the need for additional model development;

identifying high priority watersheds (high sensitivity/ risk and presence or likelihood of development activities) for expedient application of the model(s);

upgrading existing FDIS files where necessary to make them model-ready; and

filling in FDIS phase 1-3 planning data to provide watershed contiguity when modelling over large areas.

It is also very desirable to complete the TRIM watershed atlas for running FHAT 20, and probably any other models that may be developed.

Status:

The FHAT 20 model is being tested by Sustainable Resource Management headquarters for 2 Omineca watersheds and monitoring of the model's effectiveness will take place this fall. Although FHAT 20 is being tested and refined in several areas of the province, only a limited user needs assessment has been done locally and more extensive evaluation of FHAT 20 in the region is required.

Tactical Objectives:

To refine or develop suitable habitat models capable of predicting fish and fish habitat distribution within predetermined statistical confidence limits;

To design a implementation plan for predictive mapping of the distribution of fish and fish habitat throughout the Omineca-Peace Region that:

- supports strategic planning activities such as timber supply reviews;
- enables users to assess the risk of management decisions and determine where further inventory is needed to confirm predictions;
- reduces field inventory costs;
- supports the establishment of Local Area Agreements.

The success of this tactic depends on successful implementation of Strategy 1, Tactic 1 (Regional Fish and Fish Habitat Information Consolidation) and Tactic 1 of this strategy (Regional Fish and Fish Habitat Inventories). Completion of this tactic will, itself, enhance the knowledge status and utility of Strategy 1 tactics.

Tasks, Deliverables, Targets and Milestones (Tactical):

Evaluate the effectiveness, efficiency (cost/benefits), end-user utility of the FHAT20 model in various watersheds throughout the region;

Determine if FHAT 20 needs modification or if testing and development of other models is required;

If warranted adapt existing (e.g. recalibrate or add fields) or develop new models;

Validate the model(s);

Develop a strategy for regional application; evaluate available data for model readiness, prioritise watersheds to model and prepare data ;

Report and extension;

Update the information catalogue and re-evaluate gap analysis.

Cost Sharing

Ministry of Sustainable Resource Management headquarters staff are developing and testing the FHAT 20 model, working with various provincial IFPAs to expand the application of the model over larger areas, and providing user support to those agencies using/testing the model.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		300 000	300 000	300 000	240 000	200 000	1 340 000	5+

Strategy 3: Aquatic Systems Ecology	
Tactic 1	Aquatic Ecosystem/Forest Development Interactions

Status of Knowledge:

One of the key underpinnings of sustainable forest management is knowledge and anticipation of the potential for environmental impacts from forestry activities on other forest dependant resources, and seeking opportunities to mitigate or avoid the impacts.

Currently, our understanding of the interactions between forest development activities and fish and fish habitat is incomplete, thus limiting our ability to fully evaluate and mitigate impacts where they might occur.

There is a small body of research on fish/forestry interactions and aquatic ecosystem dynamics, but much of it is based on coastal or other, non-local ecosystems and many questions are still unanswered. Stakeholders are not always aware of ongoing research projects and their potential relevance to the forest industry, which also limits our ability to evaluate and mitigate aquatic ecosystem impacts when they occur.

Tactical Summary:

This tactic calls for an initial planning task: engage a collaborative design team to identify interactions between forest development activities and fish and fish habitat parameters and set these out in a matrix. This will incorporate and build on existing efforts of this nature (i.e. the Southern Interior Forest Extension and Research Partnership - SIFERP). A list of poorly understood interactions will be identified using the matrix and used to generate research questions. The goal will be to answer research questions identified and to further investigate fish/forestry interactions if the need is identified through research results.

While the activity is regional in scope, the forestry practices and life history under investigation interact at a much finer scale. Research issues will likely be operational in scale and nature (undertaken at the site, management unit, or watershed level) but the regional team will collaborate in oversight and prioritisation of the work and as such, the knowledge generated will be regionally applicable. Knowledge gaps are anticipated to be filled by a combination of both monitoring and research activities. Monitoring the abundance of index populations of key fish species (e.g. bull trout, Arctic grayling) annually in each forest district, by appropriate methods (e.g. fish fence, snorkel survey, catch-per-effort of various capture methods) will provide some quantitative indication of the sustainability of development.

A review of existing primary and secondary literature and Watershed Restoration Program research will ensure no redundant investment occurs.

Development parameters that are of particular interest and should be in the matrix include:

- road development – density, drainage and crossing structures, status
- cumulative impacts, or the amount of equivalent clear-cut area (density of development) in a watershed.

Status:

Some work has been undertaken for certain aquatic parameters (flow, sediment sampling) and on specific development sites, but the information is not organised or synthesised and no prioritised research strategy currently exists. As such, this activity is new.

Tactical Objectives:

To study the interactions of forest development activities and aquatic ecosystems in order to enhance our understanding of the potential impacts to sensitive fish populations and habitats, and

To develop management options to prevent or mitigate negative impacts of forest development activities on aquatic ecosystems.

Tasks, Deliverables, Targets and Milestones (Tactical):

This tactic is designed to be implemented via two, successive projects:

Project 1 - Aquatic Ecosytems Research Problem Analysis and Experimental Plan;

Project 2 - Aquatic Ecosytems Research Project Implementation.

Specific tasks and costs are presented at the project level.

Cost Sharing

Partnerships:

This activity will involve research partnerships with other agencies and specific research questions may be forwarded to the Forest Investment Account research program or the Habitat Conservation Trust Fund for funding consideration.

Project 1	Aquatic Ecosystem Interactions Research Problem Analysis and Experimental Plan

Project Status:

New

Project Objectives:

Conduct a research problem analysis of aquatic ecosystem dynamics knowledge constraints; and

Undertake collaborative design of suitable experimental project(s) and working plans.

Project Tasks, Deliverables, Targets and Milestones:

Establish a collaborative (agency, industry, end-user) design team to undertake this project and build on existing SIFERP research recommendations;

Establish a research matrix that tabulates development activities and fish and fish habitat (aquatic ecosystem) parameters to establish interactions - real or potential risks to fish and fish habitat;

Review existing primary and secondary literature and Watershed Restoration Program research to ensure that no redundant investment occurs;

Conduct a gap analysis to identify priorities for completing the matrix (including efficiency considerations/cost/benefit for filling gaps);

Prepare a research questions report;

Design an appropriate experiment(s) and prepare a research plan.

Cost Sharing

Partnerships:

This activity will involve research partnerships with other agencies and specific research questions may be forwarded to the Forest Investment Account research program or the Habitat Conservation Trust Fund for funding consideration.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000						1

Project 2	Aquatic Ecosystem/Forest Development Interactions Research Project

Project Status:

New

Project Objectives:

To study the interactions of forest development activities and aquatic ecosystems in order to enhance our understanding of the potential impacts to sensitive fish populations and habitats; and

To develop management interpretations and options to prevent or mitigate negative impacts of forest development activities on aquatic ecosystems.

Project Tasks, Deliverables, Targets and Milestones:

Implement the identified research project(s);

Analyse research results, and derive forest management interpretations and best practice recommendations, with the assistance of the collaborative design team;

Prepare and present reports;

Extension of knowledge;

Implement research monitoring and undertake a periodic updating of the research matrix, with the continued assistance of the collaborative design team.

Phase 2 tasks should be ongoing, until the research matrix gaps are filled, at which time the monitoring plan should be established.

Cost Sharing

Partnerships:

This activity will involve research partnerships with other agencies and specific research questions may be forwarded to the Forest Investment Account research program or the Habitat Conservation Trust Fund for funding consideration

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			400 000	400 000	400 000	400 000	1 600 000	4+

Tactic 2	Aquatic Ecosystem Dynamics

Status of Knowledge:

Currently, our understanding of the different elements of fish life histories, fish habitat, population dynamics, and interactions between them is incomplete, thus limiting our ability to fully evaluate and mitigate negative impacts from external pressures where they might occur.

Tactical Summary:

The cornerstone of this knowledge enhancement tactic is collaborative research design.

Engaging a collaborative design team to undertake research planning and identification of research projects is strongly advocated. Regional research direction and design should be based on the knowledge gaps in priority watersheds, for priority fish species and in aquatic ecosystem parameters. This approach will build on existing SIFERP research recommendations.

Co-ordination of this tactic with that of Tactic 1 (Forest Development/Aquatic Ecosystem Interactions) is recommended for the sake of research efficiency.

Status:

Some fisheries research work has been undertaken; however, the information is not organised or synthesised and no research strategy currently exists for this region. As such, this activity is a new knowledge activity relying upon some previously completed work and necessitating some new work.

Tactical Objectives:

To improve understanding of the key elements of aquatic ecosystem dynamics, their contribution to fish and fish habitat management, and interactions between them forestry activities;

To compliment research on forest development/aquatic ecosystem interactions (Tactic 1);

To provide fish and fish habitat management and forest management interpretations which may be used to design preventative and ameliorative means (policies, practices and local guidelines) to preserve the integrity and health of aquatic ecosystems; and

To identify those aquatic ecosystem parameters for which further research is required to satisfy knowledge gaps

(e.g. habitat thresholds, benchmarks, sustainability indicators, species distribution, population dynamics and life histories, sensitivity to ecosystem disturbance, water quality and quantity).

Tasks, Deliverables, Targets and Milestones (Tactical):

This tactic is designed to be implemented via two, successive projects:

Project 1 - Aquatic Ecosytems Research Problem Analysis and Experimental Plan;

Project 2 - Aquatic Ecosytems Research Project Implementation.

Specific tasks and costs are presented at the project level.

Project 1	Aquatic Ecosytem Dynamics Research Problem Analysis and Experimental Plan

Project Status:

New

Project Objectives:

Conduct a research problem analysis of aquatic ecosystem dynamics knowledge constraints; and

Undertake collaborative design of suitable experimental project(s) and working plans.

Project Tasks, Deliverables, Targets and Milestones:

Establish a collaborative (agency, industry, end-user) design team to undertake this project;

Conduct an information "needs analysis". Canvass what are end users' needs and determine what management questions that need to be answered;

Define aquatic ecosystem parameters for which information needs to be gathered

Conduct a gap analysis to identify priorities for resolving knowledge gaps (including efficiency considerations/cost/benefit for filling gaps) and initiate the appropriate research activities (stakeholder, partnerships, FRBC research);

Identify required research and potential researchers; and

Design an appropriate experiment(s) and prepare a research plan.

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000						1

Project 2	Aquatic Ecosystem Dynamics Research Project

Project Status:

New

Project Objectives:

To study the key elements of aquatic ecosystems, their interactions and dynamics, and relationships between them and fish populations and habitats; and

To develop management interpretations and options to prevent or mitigate negative impacts of forest development activities on aquatic ecosystems.

Project Tasks, Deliverables, Targets and Milestones:

Implement the research project(s) plan.

Report.

Add to consolidation and catalogue and information system.

Derive interpretations and application to management direction with the assistance of the collaborative team.

Implement research extension of knowledge.

$400,000 per year in subsequent years for research

Activities should be ongoing, until the identified priority gaps are filled, at which time secondary priorities and a monitoring plan for the work already done should be established.

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			400 000	400 000	400 000	400 000	1 600 000	4+

Strategy 4: Aquatic and Riparian Ecosystem Management[7]

Status of Knowledge:

The Problem

The potential impacts of forest harvesting activities on receiving water quality and freshwater biota are generally well known within the resource management community. MacDonald et al. (1991) have summarised forest harvesting impacts to the aquatic environment, including the loading of sediment and nutrients, temperature modifications and contamination by herbicides. Of those identified, it is accepted that increased in-stream sediment is the dominant impact of forestry on water quality.

Sediment has the potential to damage the aquatic environment, particularly if it deposits on the stream bottom. Suspended sediment clouds water, shading aquatic plants from necessary sunlight and impairing the visual response of fish. Depositional sediment, sediment that settles upon the streambed, may reduce interstitial oxygen concentrations resulting in the suffocation of invertebrates and fish eggs. The relative importance of sediment on the benthic environment has been recognised by many authors (Hynes 1971, Murphy and Hall 1981, Gurtz and Wallace 1984). Sediment concentrations that may have only minor impact on organisms within the water column may present major difficulties for those on and within the substrate once sediment deposits.

The BC forest sector is largely managed by prescription. Prescriptive development guidelines designed to protect water quality abound, but "results based" evaluation of forest management impacts is lacking. Are prescription guidelines for maintaining aquatic environments effective when applied to the variety of habitat sensitivities and terrain conditions present in the Omineca Peace? Are these guidelines being followed by industry operators whose levels of skill in and commitment to resource management may vary?

In recent years, the forest sector has begun to see the need for applying water quality/quantity tools that support sustainable forest management and decision making. For example:

"There is increasing interest in forestry certification from wood products customers, the forest industry and government. Currently in British Columbia there are initiatives by both industry and government to pursue the different certification systems such as ISO 14001, CSA Sustainable Forest Management System, Sustainable Forestry Initiative (SFI) and Forest Stewardship Council (FSC). Each of these systems requires the applicant to address water quality and quantity in some form. In addition, each system requires quantifiable, scientifically sound programs to measure and report on water quality and quantity parameters. If such parameters indicate poor performance the applicant is expected to make improvements to its system to improve performance on water quality and quantity."[8]

An objective means of determining whether or not water quality is adequately protected has yet to be employed in this region. Many forest management documents contain generic statements like "maintain the natural water quality" or "prevent sediment or other contaminants from entering streams". However, they usually fail to indicate how these goals will be evaluated.

Specific knowledge gaps associated with water quality in aquatic and riparian ecosystem management are:

water quality objectives (or BC criteria) for induced turbidity and/or total suspended solids for drinking water or aquatic life;

water quality objectives (or BC criteria) for induced benthic sedimentation;

points of convergence between watercourses and the forestry activities (e.g. road crossings, slides, trails, etc);

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[7] This strategy is based on recommendations submitted by N.B. Carmichael, R.P. Bio, Impact Assessment Biologist, Ministry of Water, Air and Land Protection, Omineca-Peace Region.

[8] Personal communication, Andrew de Vries, Canadian Forestry Products Ltd., Chetwynd BC (2001) (to N.B. Carmichael.

specific high value points or reaches for aquatic life (fisheries) that allow us to prioritise the convergence points;

sediment source survey data for the assessment area;

suspended solids and/or turbidity data (water quality data for protection of drinking water and/or aquatic life);

characterisation of induced benthic sedimentation at priority sites (sediment particle size data for protection of aquatic life).

A solution to the water quality assessment problem must also consider the effect of water quality. For example, the measurement of suspended solids concentrations must be accompanied with water quantity data in order to determine the total load of sediment, perhaps in kilograms per hour.

The Recommended Knowledge Solution

Given this awareness, therefore, some type of aquatic assessment is required to determine the relative impacts of forest harvesting practices as a condition of forest sector eco-certification. How might this be undertaken expediently within a forest licensee operating area, for example in a specific Riparian Management Area (RMA)?

The degree to which forest harvesting actually impacts the environment will depend on the type of harvesting activity in question and on the sensitivity of the local environment. Regional differences in climate, geology, and hydrology will influence both watershed sensitivity and the effects of local forest harvesting. Accordingly, to assess the impact of a harvesting activity, individual watershed assessment, applied on a representative basis, is preferable to the application of research findings from watersheds that may be remote and quite different in nature. To effectively organise the assessment of forest harvesting impacts on water quality, a logical plan and technical framework must be developed for each management area, in this case the Omineca-Peace region of British Columbia.

The Pollution Prevention section of the Ministry of Water, Land and Air Protection has drafted a strategic plan and technical framework document for establishing water quality programs to investigate forest-harvesting impacts in the Omineca-Peace region.

Implementation of this strategy and framework will result in:

Definition of the measurement parameters and sampling protocols necessary to evaluate the impact of forest practices on the aquatic and riparian environment;

Identification of criteria (forest harvesting activities, specific watersheds or watershed characteristics) for assigning water quality monitoring priorities; and

Provision of the type of water quality information required for forest development planning and eco-certification.

Water quality criteria (guidelines) represent safe conditions or safe levels of a substance, and are set to protect various water uses. A criterion is defined as "A maximum and /or a minimum value for a physical, chemical or biological characteristic of water, sediment or biota, which should not be exceeded to prevent specified detrimental effect from occurring to a water use, including aquatic life, under specified environmental conditions." Water quality objectives are watershed specific applications of provincial criteria.

Given that the single greatest impact of forest operations to aquatic life is via sediment loading and movement, a primary industry goal could be "to meet water quality criteria for particulate matter". Provincial criteria have been established for the protection of aquatic life, drinking water and recreation from induced turbidity, non-filterable residue and benthic sedimentation, as per British Columbia Water Quality Guidelines (Criteria): 1998 Edition (see attached). The existence of provincial criteria suggests that in many cases, detailed biological assessment (e.g. of benthic invertebrates upstream and downstream of a culvert installation) may not be required. And, for ease of application, provincial water quality criteria can in many cases be applied as watershed specific objectives.

If we accept the value of water quality criteria to indicate when or where aquatic impact may be occurring, industry's desire to protect water quality can and should be met with some form of quantitative assessment. This would link forest operations to aquatic habitat protection as identified by aquatic life criteria and it would confirm industry's performance under the current approach of prescriptive management. The current emphasis on prescriptive management needs to be backed by some level of assessment in order to determine whether water quality criteria are being exceeded by forest operations.

Water quality criteria could be applied to the land base on a point or non-point source basis. Point sources (road crossings, skid trails, slides, etc that potentially generate suspended solids in the watercourse) would be the easier to assess. The designation of non-point source is a matter of scale. Multiple small sediment sources from a single cut block might be considered a non-point source. Similarly, criteria could be applied to long term temporal assessment (of cumulative impact) and/or to short term spatial assessments (of stream crossings).

Strategic Summary:

This knowledge strategy is based on a draft plan prepared by the Pollution Prevention section of the Ministry of Water, Land and Air Protection, which recommends a strategy and technical framework for undertaking water quality monitoring of forest-harvesting impacts in the Omineca-Peace region. Tactical recommendations presented here also reflect the key knowledge elements identified in the Pollution Prevention strategy.

It should be noted, however, that the following strategy and tactics might not represent the water quality concerns of the Regional Water Management Branch.

The Riparian and Aquatic Ecosystem Management Strategy is designed to generate the necessary data required to objectively evaluate the impacts of streamside forest practices on aquatic and riparian environments. This data and information will provide resource managers suitable criteria with which to determine both a) operator compliance with the Forest Practices Code (FPC) and b) the effectiveness of the FPC at protecting the aquatic environment.

The following tactics are recommended to fully implement this strategy:

Potable Water Quality Objectives and Assessment; and

Aquatic Habitat Water Quality Objectives and Assessment.

Implementation of this strategy will result in:

Definition of the measurement parameters and sampling protocols necessary to evaluate the impact of forest practices on the aquatic and riparian environment;

Identification of criteria (forest harvesting activities, specific watersheds or watershed characteristics) for assigning water quality monitoring priorities; and

Provision of the type of water quality information required for forest development planning and eco-certification.

Status:

New

Strategic Objectives:

To quantitatively assess the effects of forest harvesting practices on the aquatic environments of the Omineca-Peace Region, in order to support forest management decisions that maintain riparian and aquatic ecosystem integrity, and water quality.

Tasks, Deliverables, Targets and Milestones (Tactical):

Described within tactical details.

Cost Sharing

Partnerships:

Ministry of Sustainable Resource Management, Water Management; Ministry of Water, Land and Air Protection, Fisheries; Forest Industry Licensees.

Tactic 1	Potable Water Quality Objectives and Assessment

Project Status:

New. Drinking water quality may not be a primary concern in many forest watersheds given the lack of need for potable supply. Nonetheless, increasing turbidity and/or total suspended solids in the area (from road runoff, mass wasting, etc) will lessen water potability. Disinfection costs increase and water quality aesthetics decline with increasing turbidity. Increased turbidity thus represents a negative impact to the resource value. A drinking water quality objective could be monitored at selected sites by way of manual and/or automated turbidity and total suspended solids programs.

Project Objectives:

To quantitatively assess the effects of forest harvesting practices on the aquatic environments of the Omineca-Peace Region, in order to support forest management decisions that maintain riparian and aquatic ecosystem integrity, and potable water quality.

Project Tasks, Deliverables, Targets and Milestones:

Define the water quality assessment parameters;

Specify the sampling or monitoring protocols;

Define the initial water quality objective (s);

Prioritise the watersheds and forest practises for initial assessment of water quality, and ongoing monitoring;

Analyse the relative impacts and report;

Confirm or revise the initial water quality objective(s)

Implement water quality objectives and assessment training and extension;

Develop suitable forest management decision support tools (management guidelines, expert systems etc.).

Cost Sharing

Partnerships:

Ministry of Sustainable Resource Management, Water Management; Ministry of Water, Land and Air Protection, Fisheries; Forest Industry Licensees.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	100 000	100 000	100 000	100 000	450 000	5+

Tactic 2	Aquatic Habitat Quality Objectives and Assessment

Project Status:

New.

A water quality objective for induced total suspended solids that will protect aquatic life is a prime concern of effective resource management. Increased sediment loading to watercourses would be largely negative to the resource value. Having noted this, the effective measurement of turbidity and/or total suspended solids from a discontinuous, storm related discharge might be difficult and/or costly. A water quality objective for aquatic life could be monitored at select sites by way of manual and/or automated turbidity and total suspended solids programs.

The single most important parameter affecting the aquatic life resource is the level of induced benthic sedimentation. Excessive levels will cause significant negative impact on the health of aquatic life by removing spawning habitat, reducing egg to fry survival, reducing benthic invertebrate survival, etc downstream of points of convergence. Implications to the resource value would be clearly negative.

Quantitative assessments of substrate particle size at priority sites would be an important method by which to learn whether the induced benthic sedimentation objective is being exceeded as a result of forest activities. It would be a positive for both water quality management and for an industry that calls for performance based, "results oriented" management. And while we consider the induced benthic sedimentation water quality objective to be a very important aquatic knowledge point, it would be relatively inexpensive to monitor.

Project Objectives:

To quantitatively assess the effects of forest harvesting practices on the aquatic habitats of the Omineca-Peace Region, in order to support forest management decisions that maintain riparian and aquatic ecosystem integrity, and specific habitat features.

Project Tasks, Deliverables, Targets and Milestones:

Define the water quality assessment parameters;

Specify the sampling or monitoring protocols;

Define the initial water quality objective (s);

Prioritise the watersheds and forest practises for initial assessment of water quality, and ongoing monitoring;

Analyse the relative impacts and report;

Confirm or revise the initial water quality objective(s)

Implement water quality objectives and assessment training and extension;

Develop suitable forest management decision support tools (management guidelines, expert systems etc.).

Cost Sharing

Partnerships:

Ministry of Sustainable Resource Management, Water Management; Ministry of Water, Land and Air Protection, Fisheries; Forest Industry Licensees.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		200 000	300 000	300 000	300 000	300 000	1 400 000	5+

ISSUE 8: INCOMPLETE UNDERSTANDING OF BOREAL MIXEDWOOD STAND DYNAMICS AND MANAGEMENT OBJECTIVES

Overview Description of the Regional Strategic Issue:

Without a thorough understanding of the inter-specific dynamics of conifer-broadleaf mixtures (predominantly white spruce/trembling aspen, interior spruce/aspen, or interior spruce/birch), accurate, reliable and meaningful simulation and projection of stand and forest dynamics is not possible throughout much of the northern third of the region (Boreal White and Black Spruce Zone) (BWBS), and parts of the Sub-Boreal Spruce (SBS) and Interior Cedar Hemlock (ICH) Zones. Sustainable forest management depends on sufficient representation of forest ecosystem and landscape patterns and functions, and the utility, quality and scope of information used in forest analysis. These, in turn, depend on the available knowledge and experience in interpreting the forest analysis, and the accuracy with which stand and landscape responses can be simulated and subsequently predicted.

Currently in the boreal and sub-boreal mixedwood areas, knowledge and experience in evaluating the effects of silviculture and forest management decisions on stand and landscape dynamics and function are uncertain, both from a biological and an socio-economic perspective. The key information needs identified for this issue in these Zones are (a) site productivity information; (b) greater understanding of natural disturbance, succession and stand dynamics; and (c) mixedwood management strategies.

Mixedwood Site Productivity

Current information on site productivity of young stands, and on making adjustments to old stand estimates in the inventory (OGSI adjustments), can use either SIBEC estimates or growth-intercept (GI) estimates. SIBEC estimates are unavailable or unreliable for many ecosystem units in the BWBS, SBS and ICH, and are imprecise for individual stands in these Zones.

Uncertainty remains around GI estimates, particularly for interior spruce. Spruce establishment-phase growth patterns have changed considerably with continually improving planting stock and seedling handling, and these patterns may persist beyond breast height. GI estimates are unavailable for aspen and birch.

Data are needed to expand the range of application of the Mixedwood Growth Model (MGM), particularly, data on early stand development. Models, such as TASS (and the yield tables in TIPSY), which reflect ideal (i.e., unimpeded growth) conditions, must be adjusted to reflect more 'typical' conditions experienced within the BWBS, SBS and ICH. Current provincial default adjustments (Operational Adjustment Factors) are overly conservative. Further sampling of landscapes (PSPs or TSPs, or some other appropriate unit), or analysis units modelled in Timber Supply Analyses which represent a large landbase, such as a Timber Supply Area or Tree Farm licence, is required to obtain better OAFs, or replace them with locally-specific reductions. For example, these yields predicted in TIPSY for managed stands in the Peace area, are thought to be too high, and may indicate that SI curves in the Peace require additional assessment. Currently available models are insufficient to handle all stand types, and particularly the more complex stand types. For the BWBS, SBS and ICH, there is currently no well-proven model to capture complex stand dynamics for mixed species stands. There is a need for a northern G & Y co-operative to co-ordinate various efforts.

There are several questions related to the definition of site productivity. How is site index (SI) assigned, and is it (reasonably) accurate? How is SI for secondary and tertiary species incorporated into analyses? What are the associated impacts on growth and yield curves? There is a pressing need for more stem analysis to be undertaken.

Mixedwood Natural Disturbance, Succession and Stand Dynamics

Mixedwood forests in central and northern BC landscapes are complex, spatially and temporally dynamic, and diverse in composition and structure. They comprise a broad range of ecosystems, ranging from those successional stages represented by pure to nearly pure broadleaf stands, to those represented by varying mixtures of broadleaves and conifers, to those represented by pure or nearly pure conifer mixes. Complexity of stand development for mixedwoods arises because of differences in species recruitment strategies, shade tolerances, juvenile growth rates, and lifespan or time to maturity of the main species. The structure and composition of mixedwoods are also influenced strongly by time since disturbance, amount of forest floor removal, survival of rootstocks, and seed sources.

Mixedwood Management Strategies

The increasing focus on biological diversity and ecological processes has stimulated interest in mixedwood forest management. The policies, practices, and information bases in BC do not, however, adequately support mixedwood management. Thus, it is an important first step to establish an appropriate working definition of mixedwood sites, stands and forests. Understanding the successional pattern of mixedwood forests and incorporating this knowledge into the definition will guide the development of management prescriptions. The abundance, diversity, and relative position of component species at each successional stage depend on, for example, the disturbance type, pre-disturbance stand composition, stand and landscape ecology, site conditions, current and historic management, and intensity of disturbances across the landscape.

Variations in the details of the definitions may be appropriate for local situations, but the central concepts of site productivity and successional dynamics must be emphasised. These concepts underpin the utility of the definitions for planning and implementing a mixedwood management strategy and subsequent silvicultural prescriptions.

Traditional forest management has favoured simple stand structures that produce large and predictable yields of conifer timber. The increasing focus on biological diversity and ecological processes has stimulated interest in retaining mixedwood forests. Mixed-species forests are more pest-resistant, contribute to biological diversity, and enhance ecological processes (e.g., nutrient cycling). They are ideal candidates for integrated resource management because they support multiple values. Market conditions, patterns of wood supply, regeneration costs, and stand productivity levels may provide economic advantages for mixedwood management.

Some forest harvesting operations remove conifers and create conditions that favour early successional species, such as broadleaves. Many conifer stands regenerate to mixedwood stands, and vice versa. The structure and composition of these mixedwood stands challenge such policies and regulations as those relating to species selection, stocking levels and free-growing status, for example, largely because our methodologies for assessing them were developed to assess conifer performance in monoculture plantations (i.e., they are an artefact of plantation silviculture).

Relationship to Sustainable Forest Management:

The maintenance of environmental values

Fundamental understanding of mixedwood ecology, growth and regeneration rates, and the effects of natural and anthropogenic processes is critical to planning and implementing mixedwood restoration, renewal and protection strategies which will provide the maximum ecological, social, and economic benefit possible for the resources and labour invested. This is reflected, for example, in strategic planning processes, TSRs, and forest certification procedures.

The sustainability of timber resources

The mixedwood component of SSFM will improve our understanding of the structural and functional ecological relationships in mixedwoods, at both the landscape and stand levels. The knowledge strategy will design, implement, and analyse research and operational measurements characterising mixedwood growth and yield, the effects of forest management practices on mixedwood growth and yield, and the quantity and quality of timber expected at harvest. Better estimates of renewal rates and yields of timber can promote activities which (i) assist forest industry diversification, (ii) maintain existing jobs in the harvesting and traditional processing sectors of the industry, and (iii) promote further processing and increased manufacturing of the wood supply.

The sustainable use of non-timber resources

Improved awareness of all the values present in mixedwoods has increased the complexity of management efforts. If mixedwood forests are to be managed to sustain both timber and non-timber resource values, to allow for continued traditional First Nations usage, and to promote awareness and utilisation of non-timber resources, more complete information is required to guide decision-making.

Relationship to Strategic Resource Plans and Decisions:

Strategic Decisions:

The results of this series of knowledge strategies will be readily applicable to TSR III.

Strategic Resource Plans:

The results of this series of knowledge strategies will support implementation of the Peace/Liard LRMPs, and will facilitate the definition of the Desired Future Forest Condition (DFFC) and Desired Landscape Pattern (DLP) and their application/interpretation through the Results Based Code (RBC) in Fort St. John.

Cross Reference to Management Unit Issues:

The results of the knowledge strategy for this issue will benefit the timber supply analyses undertaken in the Fort Nelson, Fort St. John, Dawson Creek, Mackenzie, Prince George, and Robson Valley TSAs. The results will also be applicable to the development of sustainable forest management plans for various management units throughout the Omineca-Peace Region, e.g., TSAs, IFPAs, EFMPPs, and the Fort St. John Code Pilot Project.

Implementing these knowledge strategies would be most effective through working partnerships amongst all the stakeholders concerned with mixedwood productivity in the various management units.

Status of Existing Knowledge:

A detailed discussion of the status of existing knowledge is presented for each strategy described in this plan.

Recommended Knowledge Solution:

General Approach:

The knowledge solution is based on three key principles:

For mixedwood management issues, a good workable answer today is better than waiting ten years or more for the perfect answer.

To verify the status (quantity and applicability) of our knowledge base, it is important that the strategy involves a re-analysis of existing bodies of information.

The status of our knowledge base will be utilised to identify knowledge gaps and to focus on new information requirements.

Some of these questions will address short-term issues but others will require longer-term assessment. We can undertake short-term analyses and modelling exercises using existing information and new information as it is produced. Answers to long-term questions need long-term research installations; we will use existing long-term installations where possible and establish new long-term installations where needed.

Specific Solutions:

The recommended solution employs three integrated, knowledge strategies:

Management of Mixedwoods

This strategy may be implemented via three, key tactics designed to:

Provide a working definition of mixedwood sites, stands and forests which is based on biological, structural and successional criteria;

Enhance understanding of mixedwood tree, stand and forest processes in order to support the design of ecologically sound mixedwood management regimes.

Improve knowledge needed to select appropriate silvicultural regimes at the stand establishment and post harvesting phase of management; and

Enhance the understanding of forest level economics and biodiversity in mixedwood landscapes.

Mixedwood Yield Prediction

This strategy may be implemented via two, key tactics that:

Provide a suitable indicator of site productivity potential for stands comprising mixtures of species;

Support the development of suitable tree and stand growth and yield prediction models, and forest level projection models; and

Explore the long-term implications of management practices on mixedwood site productivity potential.

Mixedwood Knowledge Extension

This strategy complements each of the first three, by improving the utility of the improved information and knowledge base as knowledge investments yield results.

Specific discussions of these strategies and tactics follow in this plan.

Relationship to other SSFM Knowledge Strategies

The knowledge strategies of this issue link to the following other SSFM Issues:

Issue #1:

Current forest inventories in the Omineca/Peace region are old, especially in the context of mixedwoods. Thus, the accuracy and reliability of these inventories make future predictions of timber values and production uncertain at the stand- and landscape-levels. It is essential that the data sets (both spatial and attribute) are complete and current to support mixedwood management within each management unit.

Issue #5:

In the Omineca-Peace Region, there is still inadequate understanding of the role that natural disturbance plays in shaping the structure, distribution, and productivity of the mixedwood forest. Our knowledge of successional dynamics for mixedwoods is incomplete, preventing meaningful productivity assessments and projections at the stand- and landscape-levels.

Issue #6:

Sustainable Forest Management is a structured process of deduction aimed at selecting and implementing the most appropriate management actions for a specific forest estate. Management appropriate for coniferous stands and landscapes are not suitable for mixedwood stands and landscapes. Currently for mixedwood management, there are no stated forest-level productivity objectives upon which forest-level productivity responses can be evaluated. Also, no forest-level feedback control exists, since current mixedwood management is not focussed on achieving a specified mixedwood structure, condition, or productivity.

Issue #9:

Mixed species management may provide some realistic, cost-effective solutions to particular forest pest concerns, especially some related to productivity of young stands (e.g., spruce leader weevils and lodgepole pine rusts). Mixed species options may also provide some opportunity for preventative strategies for forest pests that attack older stands (e.g., bark beetles) and create landscape-level impacts.

Issue #11:

The use of alternative harvesting methods is considered a potentially valuable solution to some of the spatial harvesting challenges inherent in mixedwood management. Wider-scale implementation and adaptive management experience with alternative silviculture systems in mixedwoods is required, especially in areas in which productivity issues and non-timber forest values are important.

Issue #14:

Site productivity is a key element in the projection of stand dynamics and yield across mixedwood landscapes and stands. Without an accurate means of projecting mixedwood stand and, ultimately, forest growth, sustainable management of the suite of mixedwood forest resources will not be attainable.

Strategic Performance Indicators, Targets & Milestones:

Strategic performance indicators vary by strategy. Specific information is provided in the descriptions of each strategy and tactic.

Strategy 1: Management of Mixedwoods

Status of Existing Knowledge:

Three tactics are required to fully implement the Management of Mixedwood knowledge strategy (described in Strategic Summary, below). The overall status of knowledge follows:

Organisation, synthesis and analysis:

Working definition of boreal mixedwood 'site,' 'stand' and 'forest' from Ontario

Draft definition of boreal mixedwood 'site,' 'stand' and 'landscape' for BC (R. Kabzems, June 22, 2001)

A **Boreal Mixedwood Site** is an area with climatic, topographic and edaphic conditions that favour the production of closed canopy stands dominated by trembling aspen, balsam poplar, lodgepole pine, white birch or white spruce.

A **Boreal Mixedwood Stand** is a tree community on a boreal mixedwood site in which no single species comprises 80% or more of the total basal area, and 50% or more of the stand area is in an ecotone between the constituent species.

A **Boreal Mixedwood Landscape** is an aggregation of tree communities on boreal mixedwood sites, in which no single tree species comprises 80% or more of the aggregated total basal area, within the confines of a definable physiographic boundary. The aggregated tree communities may be mixtures of several tree species within each stand or mosaics of single species stands.

Fort Nelson – forest-level economic analysis of alternative silvicultural systems and landscape analysis of management strategies (and combinations of strategies) using SFMM

Canfor (TFL 48) – Hammish Kimmin's work

There are several information sources (including some from Northeastern BC), some of which have included integration and analysis.

Inventory:

The forest inventory database is inadequate for defining and describing mixedwoods, and for the level of analysis required for the development and testing of mixedwood management strategies. Better inventories of tree species composition, forest cover, age classes, and volume (basal area) will improve our definition and descriptions of mixedwoods, and our analyses of management strategies.

Extension:

NSC, NIVMA, MOF, and FERIC have a substantive body of knowledge which is being made available through extension products, tools and activities

Supporting information base for mixedwood definitions and descriptions available from Ontario and Alberta as well

Research:

FRDA mechanical site preparation trials (broadleaf community dynamics, species interactions, stand development); sites are over 10 years of age and have provided good information flow

MOF and UNBC work on broadleaf/conifer interactions, conifer underplanting, stand dynamics, and mixedwood and broadleaf stand productivity

Partial cutting research in Fort Nelson

MOF and UNBC birch genecology work

UNBC and Canfor work on the effects of overstory broadleaf species and the spruce leader weevil

Considerable amount of research underway in Alberta

Monitoring:

There are several BC research installations which have been monitored since project establishment

PSPs have been established for the partial cutting research underway in Fort Nelson

Strategic Summary:

Three component tactics are required to fully implement the Management of Mixedwoods knowledge strategy:

Defining the Mixedwoods

Traditional forest management has favoured simple stand structures that produce large and predictable yields of conifer timber. The increasing focus on biological diversity and ecological processes has stimulated interest in retaining mixedwood forests, yet existing policies, practices, and information bases do not adequately support mixedwood management strategies. At the heart of the issue is the absence of a clear, concise, working definition of mixedwood sites, stands and forests.

Stand Level Silviculture

There are a number of potential silvicultural pathways for mixedwood management. At the stand level, better information is needed to aid in strategy selection and implementation. There are two 'categories' of stand-level information needs:

those associated with early stand development and stand tending decisions, and

those associated with residual stand development after harvesting.

Greater emphasis on the broadleaf component of mixedwood stands demands that the genetic resource, in particular for Western paper birch and trembling aspen, be managed explicitly. Initiatives such as broadleaf provenance trials, gene research and archives are required.

Forest Level Management

At the landscape level, we need more comprehensive information so that our analyses can include economic and biodiversity considerations. Also, we need to understand the cumulative impacts of the stand-management strategies implemented so we can determine how much of any one strategy or combinations of strategies we can apply at any one time.

Forest management planning demands an accurate inventory of the mixedwood resource. The status and description of boreal mixedwoods are being inhibited by poor inventory information on the coniferous understory. Further trials of remote sensing techniques to describe multi-layered, mixed species stands (e.g., CASI, leafless photography) are needed. Application of the new (Phase II, RIC) vegetation inventory and Terrestrial ecosystem Mapping will improve the initial data bases and model predictions.

Improvements in management prescriptions also require a deeper understanding of structural and functional [illegible] relationships at both the landscape and stand levels. Natural disturbances and early successional patterns should be examined for biologically appropriate management and regeneration strategies. Natural process studies which address understory light, microclimate, and nutrient cycling are needed to help understand the interactions (e.g., competition) between species in mixedwood stands. There is a need for improvement in the understanding of the genetics of mixedwood tree species and the extent and implication of forest pests in managed and unmanaged mixedwood forests.

Status:

Many of the projects making up the tactics of this strategy are not new. Much excellent progress has been made, and much good work is underway. Successful implementation of this initiative will, however, require acceleration of the research effort in order to resolve the many gaps in the knowledge base.

Strategic Objectives:

To provide a working definition of mixedwood sites, stands and forests which is based on biological, structural and successional criteria;

To improve knowledge needed to select appropriate silvicultural regimes at the stand establishment and post harvesting phase of management; and

To enhance the understanding of forest level economics and biodiversity in mixedwood landscapes.

Tasks, Deliverables, Targets and Milestones (Strategic):

Specific tasks, deliverables and milestones are discussed at the tactical level of this plan.

Tactic 1	Defining the Mixedwoods

Status of Knowledge:

The successional pattern of mixedwood forests must be a key component of the definition because it is a key guide to the development of management prescriptions. The abundance, diversity, and relative position of component species at each successional stage depend on the disturbance type and pre-disturbance stand composition.

Variations in the details of the definitions may be appropriate for local situations, but the central concepts of site capability and successional dynamics must be preserved. These concepts underpin the usefulness of the definitions for planning and implementing mixedwood silvicultural prescriptions.

Tactical Summary:

This tactic is designed to meet the need for a comprehensive, working definition of mixedwood terminology. It will be implemented via a review of national and international research and literature, as well as by involvement of local mixedwood stakeholders, researchers and other silviculture and management specialists.

Status:

New and ongoing

Tactical Objectives:

1) Develop definitions of boreal mixedwood at appropriate scales (region, landscape, stand site) to assist in determining Desired Future Forest Condition

2) Re-examine and possibly redefine Natural Disturbance types within the BWBS with object of determining Desired Landscape Pattern

Tasks, Deliverables, Targets and Milestones (Tactical):

This tactic should be initiated early in the mixedwood strategic plan since a functional working definition will influence other strategies and tactics:

Determine status of the Ontario definition of mixedwood 'site,' 'stand' and 'forest,' and the success Ontario has in applying the definition;

Summarise regional (Omineca-Peace) concerns/issues which define the need for workable definition(s) of mixedwoods;

Continue with the ongoing development of a BC definition of mixedwood 'site,' 'stand' and 'forest';

Analyse current definitions/interpretations of 'mixedwoods' at the ecological, inventory, silviculture and TSR levels;

Involve stakeholders in development of the definition of mixedwood 'site,' 'stand' and 'forest' for BC;

Circulate drafts of the BC definitions for review.

Initiate extension to stakeholders.

Monitor application of the accepted BC definitions for boreal mixedwood in resource inventory (Issue 1, VRI Strategy), silviculture programs, and in TSR III.

Cost Sharing:

Through partner MYAs, companies will provide contributions in kind as required. Ministry of Forests contributions-in-kind will be researcher time. UNBC will contribute faculty time for analysis and modelling.

Partnerships:

Partners to include BC Ministry of Forests, Canadian Forest Products, Slocan, West Fraser, Louisiana-Pacific, Slocan-LP OSB Corp., Northern Forest Research and Extension Partnership, and UNBC.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		30 000	30 000				60 000	2

Tactic 2	Stand Level Silviculture

Status of Knowledge:

FRDA mechanical site preparation trials (broadleaf community dynamics, species interactions, stand development); sites are over 10 years of age and have provided good information flow;

MOF and UNBC work on broadleaf/conifer interactions, conifer underplanting, stand dynamics, and mixedwood and broadleaf stand productivity;

Partial cutting research in Fort Nelson;

MOF and UNBC birch genecology work;

UNBC and Canfor work on the effects of overstory broadleaf species and the spruce leader weevil;

Considerable amount of research underway in Alberta;

There are several BC research installations which have been monitored since project establishment; and

PSPs have been established for the partial cutting research underway in Fort Nelson.

Tactical Summary:

This tactic consists of a wide range of literature reviews, problem analyses and research experimentation; all designed to improve the state of knowledge of mixedwood management. Many of the recommended initiatives involve continuation of existing, medium and long term research projects; all listed address contemporary knowledge gaps and information requirements, and represent an extremely cost effective means of implementing the tactic. Others represent new project recommendations designed to augment existing knowledge and research efforts.

Status:

New and ongoing research initiatives

Tactical Objectives:

To enhance understanding of mixedwood tree, stand and forest processes in order to support the design of ecologically sound mixedwood silvicultural regimes.

Tasks, Deliverables, Targets and Milestones (Tactical):

The following tasks are recommended as desirable components of the Stand Level Mixedwood Silviculture Tactic:

Establishment and Tending Phase:

Synthesise existing silvicultural information into a mixedwood management guidebook(s);

Review existing information on early stand conditions and define necessary conditions to achieve longer-term stand objectives, e.g., timber production;

Develop suitable free-growing standards:

need standards for uniform mixedwoods;

need better survey technologies;

scientific information required to develop and validate free-growing standards for uniform mixedwoods;

Develop an improved inventory classification of Sw and Si advanced regeneration as a key tool for silvicultural planning at the stand level;

Conduct an integrating factor analysis (using integrating factors such as light) for all 10- and 15-

year mixedwood silvicultural treatment installations;

Investigate the effect of clumped species distribution in managed mixedwoods to create different stand patterns (composition/proportion, size, distribution);

Initiate new or innovative approaches to establishing and tending young mixed species stands;

Initiate research trials designed to duplicate stand composition (species composition and proportion) prior to harvesting;

Establish research studies and operational trials to monitor existing studies to examine tree form and wood quality;

Undertake regeneration trials (natural and planting) for both aspen and birch;

Implement aspen and birch genecology and tree improvement research;

Install silviculture systems experiments to secure aspen and birch natural regeneration;

Undertake research studies on the effects of species mixes on forest health.

Post-Harvest Response Phase:

Synthesise/analyse existing knowledge regarding the harvesting phase in partial cuts in boreal and sub-boreal mixedwoods into a 'how to' extension publication;

Synthesise/analyse existing knowledge into a mixedwood guidebook for retention of Sw and Si during partial cutting; implications of different scenarios;

Undertake the 10-year re-measurement and analysis of the Sw underplanting study;

Initiate a new Sw underplanting experiment under different aspen canopy structures and densities;

Initiate a Si and Fdi underplanting experiment under different birch canopy structures and densities;

Undertake the 5-year re-measurement and analysis of a boreal mixedwood group shelterwood trial.

Specific tasks, deliverables, targets and milestones are presented at the project level of this tactic.

Project 1	Gene Research of Aspen

Project Summary:

Aspen is an increasingly important commercial species in BC, particularly in the NE of the province, where it accounts for about 50% of the cut. Therefore there is an urgent need to initiate research into the genecology of the species and to establish gene archives of unique populations. This is necessary to maintain genetic diversity, to better manage the species, to develop seed zones and seed transfer guidelines and to lay the foundation for a tree improvement program.

Gene conservation and genecology will be the main objectives in both the Ft. Nelson-Liard and Ft. St. John-Peace areas. Afforestation, in an effort to increase growth and yield, insect and disease resistance and wood quality of aspen, will be the main objective in the Ft. St. John-Peace area. The results of these efforts will have long-term implications for economic sustainability, land use and resource management in northern BC.

Project Status:

Little is currently known about aspen genecology in the Ft. Nelson-Liard area. Superior aspen sources have already been identified in Ft. St. John, Dawson Creek, Prince George, Prince Rupert, Cariboo, Nelson, Kamloops and north western Alberta (east of Ft. Nelson and Ft. St. John).

Project Objectives:

Aspen in the Ft. Nelson-Liard area exhibit superior growth and yield, insect and disease resistance, and wood quality compared to those in the Ft. St. John-Peace area. The objective of this project is to determine if this superiority is due to variation in the genetics of the species, the local environment, or an interaction of the two. Gene archive-provenance trials, compatible with developing seed zones and seed transfer guidelines as well as a foundation for an aspen tree improvement program, will also be established.

Project Tasks, Deliverables, Targets and Milestones:

Year 1 Reconnaissance and GPS tree positions

Helicopter and ground reconnaissance to locate aspen seed sources in the Ft. Nelson-Liard area.

Year 2 Collect seed

Collect seed from good phenotypes along environmental gradients (latitude and elevation) from the Ft. Nelson, Ft. St. John, Dawson Creek, Prince George forest districts, Prince Rupert, Cariboo, Nelson, and Kamloops forest regions as well as Western Alberta. Somewhere between 66 and 140 clones will be collected.

Year 3 Grow seedlings

Grow seedlings in two nurseries: J.D. Little (Prince George) and Kalamalka (Vernon).

Year 4 Establish and measurement of trials.

Ft. Nelson: one site, established with clonal structure.

Ft. Nelson, Ft. St. John, Western Alberta, and Prince George: one site, established with population structure at each locale.

Measure height and assess seedling quality (form, health) at establishment. Measure height and assess seedling quality at end of season.

Year 5 Assess Quality

Assess seedling quality and survival (continue annually).

Measure seedlings (continue biennially).

Site maintenance:

Carry out site maintenance annually as required.

Extension Activities:

Field tours: identification of superior clones in 2001 and in 2004 following establishment at each of the trial sites.

Workshops: Northern Silviculture Committee Winter Workshop in 2004.

Conferences: Canadian Tree Improvement Association 2002, Edmonton, AB. Western Forest Genetics Association 2005, TBA.

Extension Notes: Preliminary work into the development of seed transfer guidelines for aspen.

Cost Sharing:

Ministry of Forests will identify superior aspen stands, ensure stands are reserved until seed is collected, design genecology trial and collect seed in the southern interior. Slocan Forest Products (Ft. Nelson) will also identify superior aspen sources and provide helicopter for reconnaissance. UNBC will provide time and expertise (FRBC-Slocan Endowed Chair of Mixedwood Ecology, and Forestry Extensions Officer).

Partnerships:

Ministry of Forests, Slocan Forest Products – Ft. Nelson, University of Northern British Columbia, Louisiana-Pacific, Northern Forest Research and Extension Partnership.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
10 000	1	15 500	25 000	32 000	20 500	46 500	139 500	5+

Project 2	Gene Research of Birch

Project Summary:

Birch is an increasingly important commercial species throughout BC, accounting for 29,000 m^3 of the cut in 1995. Therefore there is a need to initiate research into the genecology of the species and to establish gene archives of unique populations. This is necessary to maintain genetic diversity, to better manage the species, to develop seed zones and seed transfer guidelines and to lay the foundation for a tree improvement program.

Gene conservation and genecology will be the main objectives in the Prince George, Prince Rupert, Cariboo, Kamloops, Nelson, and Vancouver areas. Afforestation, in an effort to increase growth and yield, insect and disease resistance and wood quality of aspen, will be the main objective. The results of these efforts will have long-term implications for economic sustainability, land use and resource management in northern BC.

Project Status:

1998

Six regional collections (Prince George, Prince Rupert, Cariboo, Kamloops, Nelson, Vancouver, and Idaho) for a total of 47 populations were made along elevational, latitudinal, and longitudinal transects.

1999

Seed sources were grown at 3 different nurseries: J.D. Little (Canfor), Landing Nursery in Vernon, and University of Idaho, Moscow.

2000

Seedlings were spring planted in three common garden trials in Prince George, Skimikin, and Sandpoint, Idaho.

Recruitment of graduate student, who, working under the supervision of the FRBC-Slocan Endowed Chair of Mixedwood Ecology and Management, is carrying out data collection and analysis on a sample of the populations.

Height measurements.

2001

Data collection (bud flush, height, health and vigour assessments).

Project Objectives:

The objective of this project is to determine if the observed variability in paper birch is due to variation in the genetics of the species, the local environment, or an interaction of the two. Gene archive-provenance trials, compatible with developing seed zones and seed transfer guidelines as well as a foundation for an aspen tree improvement program, will also be established.

Project Tasks, Deliverables, Targets and Milestones:

Year 1

Measure seedlings.

Assess health.

Assess physiological indicators of genetic variation such as bud flush, leaf drop, leaf size; set up permanent photo points for such assessments.

Year 2

Measure seedlings.

Assess health.

Assess physiological indicators of genetic variation such as bud flush, leaf drop, leaf size.

Year 3

Measure seedlings.

Assess health.

Assess physiological indicators of genetic variation such as bud flush, leaf drop, leaf size.

Intensive collection of successful seed sources for further trials.

Year 4

Measure seedlings.

Assess health.

Assess physiological indicators of genetic variation such as bud flush, leaf drop, leaf size.

Year 5

Measure seedlings.

Assess health.

Assess physiological indicators of genetic variation such as bud flush, leaf drop, leaf size.

Extension Activities:

Field tours: identification of superior clones at all 3 field locations.

Workshops: Northern Silviculture Committee Winter Workshop in 2004.

Conferences: Canadian Tree Improvement Association 2002, Edmonton, AB. Western Forest Genetics Association 2005, TBA.

Extension Note: Preliminary work into the development of seed transfer guidelines for birch.

Cost Sharing

Ministry of Forests will assist with data collection in Salmon Arm, and Sandpoint, Idaho. UNBC graduate student will assist with data collection in Prince George, and Salmon Arm. University of Idaho staff will assist with site maintenance and data collection in Sandpoint

Partnerships:

Ministry of Forests, University of Idaho, University of Northern BC, Canadian Forest Products Ltd., Ainsworth, Slocan Forest Products, Northern Forest Research and Extension Partnership

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
30 000	3	25 000	25 000	25 000	45 000	25 000	145 000	5+

Project 3	Birch Regeneration in SBS Mixedwoods

Project Summary:

Management if birch in mixtures with conifer species can improve the sustainability of BC's forest. Management of paper birch increases biodiversity values, improves forest health, enhances soil nutrients, provides overstorey shade to young conifers, and increases yield and economic return. Little is known about birch regeneration biology. Specifically, successful regeneration methods of birch have not been established for operational management and use. By studying birch regeneration in the SBS, regeneration guidelines can be developed for this species' use in mixedwood management.

Project Status:

Artificially regenerated birch trials in the field in the SBS have not proven successful. Moose browse, vole kill, and frost damage have contributed to the decline of planted birch. In addition, planting density has been noted as an issue, especially in areas where moose/vole damage will be uncontrollable.

Project Objectives:

To compare artificial and natural regeneration methods of paper birch in mixed birch-conifer stands in the field, using genetically superior birch seed from known populations.

Project Tasks, Deliverables, Targets and Milestones:

Year 1

Seed collection from identified and existing seed sources.

Planting of seed sources in the nursery.

Identification of field sites; scarification of seedbeds in preparation for planting.

Year 2

Trial implementation at field locations: seeding and planting of plots (each treatment plot approximately 10m^2).

Measurements, health assessments, germination count in the fall.

Recruitment of graduate student for further study and publications.

Year 3

Health assessments (spring and fall).

Measurements, density determination in the fall.

Year 4

Health assessments (spring and fall).

Measurements.

Year 5

Health assessments (spring and fall).

Measurements.

Deliverables:

Recommendations for free growing guidelines for complex stands.

Recommendations for birch regeneration guidelines in mixed birch-conifer stands in the SBS.

Extension:

Field tours with regional, district, and industry staff. UNBC Field Camp and Silviculture tours.

Extension note.

Presentations at workshops and conferences.

Cost Sharing:

University of Northern BC (FRBC-Slocan Endowed Chair in Mixedwood Ecology and Management), Ministry of Forests (Research Branch), Canadian Forest Products Ltd.

Partnerships:

UNBC (FRBC-Slocan Endowed Chair in Mixedwood Ecology and Management), Ministry of Forests (Research Branch), Canadian Forest Products, Northern Forest Research and Extension Partnership.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
50 000	7	15 000	25 000	20 000	40 000	20 000	120 000	5

Project 4	Mixedwood Stand Health Research

Project Summary:

Improved silvicultural knowledge of stand health (disease and insect stress resistance) is essential for sustainable management of mixedwood stands in the sub-boreal spruce zone. The broadleaf component of mixedwoods may contribute to overall improvements in stand health by decreasing pest damage. However, the requisite threshold density of deciduous cover needed to achieve this is unknown. By studying mixedwood species interactions, particularly of conifer birch mixtures in the SBS, it may be possible to enhance both stand health, biodiversity and wood quality to the value-added wood products sector.

Currently, little is know regarding optimal levels of deciduous broadleaf species required to reduce the incidence of damaging pests in conifer-broadleaf mixtures.

Project Status:

New

Project Objectives:

To assess spruce leader weevil attack in Canadian Forest Products Ltd.'s operating areas and throughout the SBS at the stand and landscape level by:

Determining how spruce leader weevil are impacted in mixed stands.

Defining an optimal level of deciduous overstorey for spruce leader weevil and crop tree growth.

Defining biological free growing objectives.

Evaluating utility of various readily obtained measures of competition.

Project Tasks, Deliverables, Targets and Milestones:

Field locations: Sinclair Mills (established), Vama Vama (established), and areas in TFL 30 (to be identified).

Year 1

Sinclair Mills: measure height, dbh, and basal area; quantify overstorey cover using LAI-2000 plant canopy analysers, Ceptometer, and quantum sensors; record temperature.

Vama Vama: collect data, including height, basal area, dbh, and incidence of weevil attack.

Canfor sites: identify stands for study using Canfor's available data; ground-truth identified stands; survey for light, temperature, and incidence of weevil attack as at Sinclair Mills.

Year 2

Sinclair Mills: measure height, dbh, and basal area; quantify overstorey cover using LAI-2000 plant canopy analysers, Ceptometer, and quantum sensors; record temperature.

Vama Vama: collect data, including height, basal area, dbh, and incidence of weevil attack.

Canfor sites: identify stands for study using Canfor's available data; ground-truth identified stands; survey for light, temperature, and incidence of weevil attack as at Sinclair Mills.

Year 3

Sinclair Mills: measure height, dbh, and basal area; quantify overstorey cover using LAI-2000 plant canopy analysers, Ceptometer, and quantum sensors; record temperature.

Vama Vama: collect data, including height, basal area, dbh, and incidence of weevil attack.

Canfor sites: identify stands for study using Canfor's available data; ground-truth identified stands; survey for light, temperature, and incidence of weevil attack as at Sinclair Mills.

Deliverables:

Recommendations for free growing guidelines for high weevil areas.

A weevil management guide, as outlined in the Extension Plan.

Extension

Field tours of weevil infested sites (Year 1 &3).

Lectures/workshops to selected groups for managing mixed species stands in high weevil attack areas; lectures/tours presented to UNBC Field Camp and Silviculture students (Yr. 1-3).

Recommendations for managing complex stands for reduced spruce leader weevil attack to Northern Silviculture Committee and Northern Interior Vegetation Management Association.

Weevil manager's handbook/field guide for high hazard areas.

Provincial free-growing guidelines for mixed species stands with regard to weevil attack.

Cost Sharing:

This project includes partnerships and cost sharing from government, private sectors and academic institutions. This project will provide enduring linkages between collaborators that will last beyond the term of the project.

Partnerships:

Canadian Forest Products Ltd., UNBC, Lakehead University, Ministry of Forests, Ministry of Water, Land and Air Protection, Canadian Forest Service, The Pas Lumber Co., and the Northern Forest Research and Extension Partnership.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		91 000	83 000	83 000			257 000	3

Tactic 3	Forest Level Management
Project 1	Mixedwood Forest Model Development

Project Summary:

Quantitative evaluations of potential mixedwood management strategies at the landscape and forest level are required to effectively apply stand level tactics to achieve desired social, economic and ecological goals. By evaluating existing models and testing model application on a defined (e.g. several landscape units, or one TSA/TFL) management area, rapid progress can be made in defining sustainable forest management goals, and the methods to achieve these goals.

Status:

A limited amount of work is currently underway in Northeastern BC (e.g. Canadian Forest Products, Chetwynd, using ATLAS and SIMFOR).

Project Objectives:

To evaluate all available models for their utility in simulation, projection and optimisation of boreal mixedwoods;

To validate and calibrate (as needed) for model application to a defined boreal mixedwood management area;

To evaluate a variety of potential management strategies by projecting future forest condition at the landscape and forest level, and by optimising for socio-economic and ecological values.

Tasks, Deliverables, Targets and Milestones (Tactical):

Year 1

Evaluate all available models for their utility in simulation, projection and optimisation of boreal mixedwoods;

Chose a defined mixedwood management area where assessment will be done;

Begin validation and calibration of chosen model(s).

Year 2

Validation and calibration of chosen model(s);

Identification of potential mixedwood management strategies applicable to defined mixedwood area;

Begin initial runs for validation.

Year 3

Evaluation and reporting of model outcomes for identified values.

Cost Sharing:

Through partner MYAs, companies will provide contributions in kind as required. Ministry of Forests contributions-in-kind will be researcher time. UNBC will contribute faculty time for analysis and modelling.

Partnerships:

Partners to include BC Ministry of Forests, Canadian Forest Products, Slocan-LP OSB Corp., West Fraser, U of Alberta, UNBC and Northern Forest Research and Extension Partnership.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	100 000	100 000			250 000	3

Project 2	Boreal Sustainable Forest Management Planning

Project Summary:

Demonstration of sustainable forest management under forest certification requires monitoring of criteria and indicators in a verifiable manner. To date, an integrated, comprehensive program has not been developed for boreal mixedwood ecosystems in British Columbia. This project would develop criteria and indicators for key ecosystem attributes, link these attributes to management plans and applications, and establish a co-ordinated monitoring program.

Project Status:

Development of criteria and indicators, within either sustainable forest management plans or certification procedures, is currently being undertaken in a number of jurisdictions. A supporting network of integrated research projects often exists. The Sustainable Forest Management Network has been addressing these questions in boreal forests, and provides a starting basis.

Project Objectives:

The overall objective is to create an adaptive management framework that describes how to measure and report on each key performance indicator chosen for sustainable boreal mixedwood management. The specific objectives are to:

Work closely with the partners to effectively communicate needs for data and resources required to develop local indicators, and monitoring and reporting plans;

Effectively interact and communicate with the partners in refining the indicator monitoring and reporting needs (e.g., defining data inputs/assumptions, frequency of monitoring, type/format of reports);

Identify a range of ecosystem components to be monitored for stand- and landscape-level management purposes;

Implement locally-developed monitoring protocols/methodology for those components which link to criteria and indicators, and back to the particular management plan(s) and/or application(s);

Design and implement a co-ordinated monitoring program which encompasses a broad range of stand ages, site types, harvesting and silviculture regimes and practices, seral stages, and natural disturbances.

Project Tasks, Deliverables, Targets and Milestones:

Year 1: Produce a boreal mixedwood sustainable forest management plan which includes the following (see Table 3.8.1 for implementation schedule):

Obtain/develop suite of boreal mixedwood indicators:

Describe for each indicator: the rationale, data availability/reliability, quality assessment, scale trends, and responsiveness;

The monitoring protocol and anticipated monitoring costs for each indicator;

Roles, responsibilities and accountabilities of people involved in monitoring and reporting on each indicator.

Assessment of data resources:

Survey the partners and all other information sources for quality and quantity of available data resources;

Update and maintain the data resources inventory as it will provide key information, particularly as monitoring proceeds.

Develop monitoring details for each indicator:

Information regarding availability of data (e.g., source, format, contact information);

Considerations for data procurement (e.g., frequency of update, precision required, complexity of task);

Data integrity information (e.g., quality control measures);

Monitoring plan/approach (identifying/describing key activities; recommended analysis procedures);

Roles and responsibilities of key people;

Reporting procedures and formats;

Cost and resources required by phase;

Recommended proxy and verifier for each indicator.

Develop reporting formats

State of the Forest Report' for the general public;

Annual reports for licensees;

Reports fulfilling legal requirements;

Managing adjustment procedures:

Assessment of the current state of the indicators and monitoring program relative to the future needs and requirements identified by the partners;

Provides valuable information on the potential roles of the partners and their contributions to the indicators and monitoring process;

This phase is an integral component of a larger adaptive management process.

Progress reports.

Years 2-5: Implement the boreal mixedwood sustainable forest management plan.

Cost Sharing:

No cost sharing or contributions-in-kind are included in this estimate of investment required for Year 1 because a great deal of the work is comprised of analysis, interpretation, report writing, information gathering, synthesis, and production activities requiring additional (outside) resources. There will be contributions-in-kind from agency and company staff in terms of being interviewed and providing

Partnerships:

The partners in this project include the Ministry of Forests, Ministry of Sustainable Resource Management, Ministry of Water, Land and Air Protection, Canadian Forest Products Ltd., Slocan Group, Louisiana-Pacific, Slocan-LP OSB Corp., UNBC, the Northern Forest Research and Extension Partnerships, the Sustainable Forest Management Network, University of Alberta, and the Canadian Forest Service (Northern Forestry Centre and Pacific Forestry Centre). The commitments of the partners will be to work with the consultant(s) in the development of the plan: provide information, provide time for interviews and report reviewing, and attend meetings as appropriate. After the plan is in place, it will be easier to identify specific commitments of partners to the monitoring and reporting activities.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
250 000	5	175 000	200 000	200 000	200 000	200 000	975 000	5+

Table 3.8.1

Project Deliverables	Start Date	Finish Date
Obtaining/developing suite of boreal mixedwood indicators	April 2002	August 2002
Assessment of data resources	April 2002	August 2002
Detailed indicators and monitoring methodology	June 2002	January 2003
Derive reporting formats	June 2002	March 2003
Management adjustment procedures	September 2002	February 2003
Progress reports	May 2002	March 2003
Detailed sustainable forest management plan	April 2002	March 2003

Strategy 2: Mixedwood Yield Prediction

Tactic 1	Estimating Mixedwood Site Productivity

Status of Knowledge:

Prediction of future forest growth and productivity is a fundamental planning tool. Existing growth and yield information for the tree species and species mixtures found in the BWBS, SBS and ICH is inadequate

There are several questions related to the definition of site productivity. How is site index (SI) assigned, and is it (reasonably) accurate? How is SI for secondary and tertiary species incorporated into analyses? What are the associated impacts on growth and yield curves? There is a pressing need for more stem analysis to be undertaken.

There is a need for a measure of site productivity which is based on SI by species, stand type, site conditions, and proportionate stand mixture, and a better understanding of what the short-term and long-term implications are for this measure. There is a basic need for enhanced information on broadleaf site index, its relationship to site series and its relationship to the site index of associated conifers. Long-term field studies are required to demonstrate the growth and yield implications of a range of potential mixedwood silviculture systems and to verify model predictions. Stand development models for mixedwoods will be more complex than those that have been used to date with conifer stands.

Tactical Summary:

This tactic is designed to resolve the lack of a suitable means of predicting the site productivity potential of managed mixedwood stands in the Boreal zone.

Status:

New

Tactical Objectives:

To complete a focused inventory of site series mapping (PEM) of Boreal mixedwoods;

To complete SIBEC and SIBEC translation to associate mixedwood species Site Index; and

To complete VRI Phase III (particularly for the Dry Willow Birch (DWB) biogeoclimatic zone) for mixedwood strata.

Tasks, Deliverables, Targets and Milestones (Tactical):

Tasks are reflected in the objectives.

Cost Sharing

Through partner MYAs, companies will provide contributions in kind as required. Ministry of Forests contributions-in-kind will be researcher time. UNBC will contribute faculty time for analysis and modelling.

Partnerships:

Partners to include BC Ministry of Forests, Canadian Forest Products, Slocan, West Fraser, Louisiana-Pacific, Slocan-LP OSB Corp., UNBC, Northern Forest Research and Extension Partnership.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000	50 000	50 000	250 000	5

Tactic 2	Predicting Growth and Yield of Stratified Mixtures

Project Summary:

There is uncertainty with regard to future stand development in stratified mixedwoods in which partial harvesting has taken place. This project will address the long-term growth response of the species present, the development or improvement of predictive models for growth and yield in these situations, and analysis of the implications for the TSR, and for other resource values, over multiple rotations in Fort Nelson mixedwood stands.

Project Status:

Limited work to date for both establishment of monitoring plots and analysis of outputs, especially in Fort Nelson Forest District. Investment to date estimated at $100K. Increased knowledge base and more rigorous analysis required.

Project Objectives:

Improved growth and yield predictions on effects of size, density and distribution of advanced white spruce regeneration on future growth and yield of white spruce-aspen mixtures.

Project Tasks, Deliverables, Targets and Milestones:

Year 1

Project scoping and specific task identification

Compile existing information from long-term PSPs and research installations in boreal mixedwoods

Measurement or re-measurement of tree growth, stand conditions, and site conditions on existing PSPs and research installations in boreal mixedwoods

Year 2

Measurement or re-measurement of tree growth, stand conditions, and site conditions on existing PSPs and research installations in boreal mixedwoods

Year 3

Analysis of tree growth data, stand and site condition data for boreal mixedwoods

Determine information gaps, especially with regard to boreal mixedwood ecosystem and landscape representation

Evaluate options to address information needs (e.g., inventory and destructive sampling versus long-term monitoring plots and other options) and implement accordingly

Begin establishment of long-term growth monitoring plots to broaden and deepen the information base for model analysis

Year 4

Continue establishment of long-term growth monitoring plots to broaden and deepen the information base for model analysis

Extension of analytical results through regular Boreal Mixedwood Working Group meetings, and workshops, seminars, and field tours

Year 5

Complete establishment of long-term growth monitoring plots to improve the information base for model analysis

Extension of analytical results through regular Boreal Mixedwood Working Group meetings, and workshops, seminars, and field tours

Deliverables, Targets and Milestones:

Products	Expected Outcomes	Completion Date
1. Series of long-term growth monitoring plots encompassing the range of silviculture systems and site conditions	Ecosystem-based database for analysis, usable in any model	On-going
2. Analysis based on existing models and information sources to predict future development of these stands and silviculture systems used	Being able to predict most likely growth and yield outcomes based on original stand conditions	Sept. 2004 (to be available for TSR III in the Peace-Liard FDs)

Cost Sharing:

Through partner MYAs, companies will do the harvesting (contributions in kind). Ministry of Forests contributions-in-kind will be researcher time, and the SBFEP implementing the harvesting project (e.g., in Fort Nelson Forest District). UNBC will contribute faculty time for analysis and modelling.

Partnerships:

Partners to include BC Ministry of Forests, Canadian Forest Products, Slocan, West Fraser, Louisiana-Pacific, Northern Foret Research and Extension Partnership, and UNBC.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
100 000	7	10 000	10 000	30 000	15 000	15 000	80 000	5

Tactic 3	Empirical Growth and Yield Monitoring

Status of Knowledge:

Models are needed to predict future stand volume, species composition, structure, long-term sustainability, succession and tree senescence, and to link to landscape or forest-level models. The MOF currently utilises two types of stand G&Y model:

process models, which simulate the biological growth processes of stands trees and stands; and

empirical models, which are based on the observed growth performance.

TASS, an empirical model is currently used to predict yields for managed conifer stands; VDYP for mixed stands. The application of MGM is being evaluated for a variety of stand types in the Peace area. No empirical stand-level growth and yield model is currently considered suitable for predicting the growth, stand dynamics and yield for mixedwood stands in the north.

The process models currently being considered/evaluated (e.g., MGM, FORCEE, SORTIE, MIXLIGHT) require calibration and further testing before application to forest-level questions.

There is a need to evaluate all models available and to prioritise their utility and data requirements before proceeding with calibration and testing. Both types of model, as well as hybrid intergrades, require empirical stand growth data, which is utilised in initial model calibration, as well as in later verification of model performance.

Potentially suitable growth and yield models are in early stages of development for the complex, multi-species, multi-cohort structures of SBS and BWBS mixedwood stands. Reliable empirical data sets representing the growth and development of a wide range of mixedwood stand types and ages is required to facilitate the design of new models.

Tactical Summary:

This tactic is designed to provide the data required for mixedwood growth and yield model development, through a combination of:

long-term PSPs with repeated measurements;

VRI (Phase II) sample plots;

long-term growth monitoring plots; and

representation of all mixedwood stand types.

A stand sample plot matrix will determine which stand types, ecosystems, variants, subzones require representation, and at what intensity plot sampling will be undertaken.

Status:

Ongoing and New

Tactical Objectives:

The objective is to improve representation of natural regeneration distributions in relation to parent root distribution so as to have the most efficient tool for estimating the establishment of "well-growing" stands.

Tasks, Deliverables, Targets and Milestones (Tactical):

Develop a survey methodology for broadleaf and mixed broadleaf-conifer stands considering parent root stock distribution, harvesting history, and site facto

Identify distribution and extent of voids in broadleaf regeneration to improve OAF1 estimates.

Link regeneration phase to future growth and yield using long term monitoring.

Complete permanent sample plot matrix .

Establish, maintain, measure and re-measure new and existing mixedwood permanent growth plots.

Design, update and maintain a suitable database for empirical observations.

Cost Sharing

Through partner MYAs, companies will provide contributions in kind as required. Ministry of Forests contributions-in-kind will be researcher time. UNBC will contribute faculty time for analysis and modelling.

Partnerships:

Partners to include BC Ministry of Forests, Canadian Forest Products, Slocan, West Fraser, Louisiana-Pacific, Slocan-LP OSB Corp, Northern Forest Research and Extension Partnership, and UNBC

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000			150 000	3

Strategy 3: Mixedwood Knowledge Extension

Tactic 1	Extension Notes, Analyses and Guidebooks

Tactical Summary:

The increasing focus on biological diversity and ecological processes has stimulated interest in mixedwood forest management. The policies, practices, and information bases in BC do not, however, adequately support existing approaches to mixedwood management. Currently in the boreal and sub-boreal mixedwood areas, knowledge and experience in evaluating the effects of silviculture and forest management decisions on stand and landscape dynamics and function are uncertain, both from a biological and an socio-economic perspective.

Status:

Some mixedwood management extension activities have been undertaken over the past ten years but mainly on an ***ad hoc*** basis. Thus, there has been little planning (i.e., needs, development) and co-ordination for these activities. There have also been no established continuing education and training objectives for mixedwood managers and management programs. Most of the extension activities have centred around field trips/tours and workshops. The current decision support tools for mixedwood management in Northeastern BC require updating.

Tactical Objectives:

The objective of these extension activities is ensure that current information and the results of research projects are brought to the end-user in a timely and appropriate manner.

Tasks, Deliverables, Targets and Milestones (Tactical):

Refer to Table 3.8.2 a) and b) for recommended scheduling and estimated costs of the extension products.

Extension Notes:

Review of available information on natural disturbances in the BWBS.

Review of information on aspen and birch effects on ecological processes and parameters in the BWBS, SBS, and ICH.

Review of information on successional dynamics of dead woody material after disturbance in boreal and sub-boreal mixedwoods.

Review of information on successional dynamics of understory vegetation in boreal and sub-boreal mixedwoods.

Techniques for visualisation of landscape changes.

Information reviews/analyses:

Landscape- and forest-level information on the costs, benefits, and 'bottom line' returns on mixedwood management strategies.

Analysis of information on the relationship of broadleaf Site Index to conifer SI, and its application to and implications for TSR.

Analysis of the utilisation and applicability of the concept of SI for mixedwood stands.

Review information on early boreal mixedwood stand conditions and define the necessary criteria to achieve longer-term stand objectives.

Review existing free-growing standards for boreal mixedwoods, and recommend standards for uniform mixedwoods, suggest improved survey methodologies, and identify information gaps to develop and validate free-growing standards for uniform mixedwoods.

Analysis of existing growth and yield models for their relevance and applicability to northern mixedwood systems (BWBS, SBS, ICH).

Analysis of the applicability of MGM to mixed species stand-level analysis for TSR.

Analysis of northern forest soils data base(s) and compile a 'state of the science' of our knowledge of northern forest soils.

New guidebooks:

- Field guide insert on relationship of Site Index to ecological information on all site types – BWBS.
- BWBS mixedwood management guidebook.
- Harvesting practices in partial cutting regimes in boreal mixedwoods.
- Harvesting practices in partial cutting regimes in sob-boreal mixedwoods.
- Retention of Sw and Si during partial cutting; implications of different scenarios.

Updating existing guidebooks:

- Seral aspen ecosystems.
- Northeast guide to identification of ecosystems in the BWBS.

Cost Sharing

In-kind contributions comprise the bulk of the investment to date, particularly from Ministry of Forests research staff. In-kind-contributions have not bee included in the estimates of investment required because a great deal of the work is comprised of development, writing, production and publication activities requiring additional (outside) staff resources.

Partnerships:

The partners in this project are the Ministry of Forests, the forest companies, the University of Northern BC, Northern Forest Research and Extension Partnership, and northern forestry consultants. There are no commitments, other than some time to plan and oversee the activities of the outside personnel, required of the partners.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
100 000	10	270 000	279 000	165 000	185 000	60 000	959 000	5

Table 3.8.2 a) Recommended Production Schedule for Mixedwood Extension Tactic 1.

Extension Deliverable	2002/03	2003/04	2004/05	2005/06	2006/07
Extension Notes					
Review of available information on natural disturbances in the BWBS	▨				
Review of information on aspen and birch effects on ecological processes – BWBS	▨				
Review of information on aspen and birch effects on ecological processes – SBS		▨			
Review of information on aspen and birch effects on ecological processes – ICH		▨			
Review of information on successional dynamics of dead woody material – BWBS	▨				
Review of information on successional dynamics of dead woody material – SBS		▨			
Review of information on successional dynamics of dead woody material – ICH		▨			
Review of information on successional dynamics of understory vegetation - BWBS	▨				
Review of information on successional dynamics of understory vegetation – SBS		▨			
Review of information on successional dynamics of understory vegetation – ICH		▨			
Techniques for visualisation of landscape changes - BWBS	▨				
Techniques for visualisation of landscape changes – SBS and ICH		▨			
Information Reviews/Analyses					
Costs, benefits and returns of mixedwood management strategies - BWBS	▨	▨			
Costs, benefits and returns of mixedwood management strategies – SBS, ICH		▨	▨		
Applicability of concept of SI to mixedwood stands - BWBS	▨				
Applicability of concept of SI to mixedwood stands – SBS, ICH		▨			
Relationship of broadleaf SI to conifer SI; TSR implications – BWBS	▨	▨			
Relationship of broadleaf SI to conifer SI; TSR implications – SBS, ICH		▨	▨		
Relationship of early mixedwood stand conditions to long-term objectives - BWBS		▨	▨	▨	

Relationship of early mixedwood stand conditions to long-term objectives – SBS				▨	▨
Relationship of early mixedwood stand conditions to long-term objectives – ICH				▨	▨
Free-growing standards for boreal mixedwoods	▨	▨			
Free-growing standards for sub-boreal mixedwoods			▨	▨	
Relevance of existing growth and yield models to mixedwoods - BWBS	▨	▨			
Relevance of existing growth and yield models to mixedwoods – SBS, ICH			▨	▨	
Applicability of MGM to mixed species stand-level analysis for TSR - BWBS	▨	▨	▨		
Applicability of MGM to mixed species stand-level analysis for TSR – SBS, ICH		▨	▨	▨	
State of knowledge of northern forest soils – BWBS			▨	▨	
Guidebook Updates					
Seral aspen ecosystems	▨	▨			
Northeast BEC guidebook	▨	▨			
New Guidebooks					
Insert on relationship of site index to ecological information - BWBS		▨			
Insert on relationship of site index to ecological information – SBS, ICH			▨	▨	
BWBS mixedwood management guidebook	▨	▨			
SBS mixedwood management guidebook				▨	▨
ICH mixedwood management guidebook				▨	▨
Harvesting practices in partial cutting regimes in boreal mixedwoods	▨	▨			
Harvesting practices in partial cutting regimes in sub-boreal mixedwoods			▨	▨	▨
Regeneration of Sw in partial cutting – BWBS	▨	▨			
Regeneration of Sl in partial cutting – SBS, ICH			▨	▨	▨

Table 3.8.2 b) Estimated Costs of Miixedwood Extension Tactic 1.

Extension Deliverable	2002/03	2003/04	2004/05	2005/06	2006/07
Extension Notes					
Review of available information on natural disturbances in the BWBS	12,000				
Review of information on aspen and birch effects on ecological processes – BWBS	12,000				
Review of information on aspen and birch effects on ecological processes – SBS		12,000			
Review of information on aspen and birch effects on ecological processes – ICH		12,000			
Review of information on successional dynamics of dead woody material – BWBS	12,000				
Review of information on successional dynamics of dead woody material – SBS		12,000			
Review of information on successional dynamics of dead woody material – ICH		12,000			
Review of information on successional dynamics of understory vegetation - BWBS	12,000				
Review of information on successional dynamics of understory vegetation – SBS		12,000			
Review of information on successional dynamics of understory vegetation – ICH		12,000			
Techniques for visualisation of landscape changes - BWBS	12,000				
Techniques for visualisation of landscape changes – SBS and ICH		12,000			
Extension notes - subtotals	**60,000**	**84,000**			
Information Reviews/Analyses					
Costs, benefits and returns of mixedwood management strategies - BWBS	20,000	10,000			
Costs, benefits and returns of mixedwood management strategies – SBS, ICH		20,000	10,000		
Applicability of concept of SI to mixedwood stands - BWBS	10,000				
Applicability of concept of SI to mixedwood stands – SBS, ICH		10,000			
Relationship of broadleaf SI to conifer SI; TSR implications – BWBS	10,000	10,000			
Relationship of broadleaf SI to conifer SI; TSR implications – SBS, ICH		10,000	10,000		
Relationship of early mixedwood stand conditions to long-term objectives - BWBS		20,000	10,000	10,000	
Relationship of early mixedwood stand conditions to long-term objectives – SBS				20,000	10,000

Relationship of early mixedwood stand conditions to long-term objectives – ICH				20,000	10,000
Free-growing standards for boreal mixedwoods	20,000	10,000			
Free-growing standards for sub-boreal mixedwoods			20,000	10,000	
Relevance of existing growth and yield models to mixedwoods - BWBS	20,000	10,000			
Relevance of existing growth and yield models to mixedwoods – SBS, ICH			20,000	10,000	
Applicability of MGM to mixed species stand-level analysis for TSR - BWBS	20,000	10,000	10,000		
Applicability of MGM to mixed species stand-level analysis for TSR – SBS, ICH		20,000	10,000	10,000	
State of knowledge of northern forest soils – BWBS			20,000	10,000	
Information reviews/analyses subtotals	**100,000**	**130,000**	**110,000**	**90,000**	**20,000**
Guidebook Updates					
Seral aspen ecosystems	25,000	10,000			
Northeast BEC guidebook	25,000	10,000			
Guidebook update totals	**50,000**	**20,000**			
New Guidebooks					
Insert on relationship of site index to ecological information - BWBS		15,000			
Insert on relationship of site index to ecological information – SBS, ICH			15,000	15,000	
BWBS mixedwood management guidebook	20,000	10,000			
SBS mixedwood management guidebook				20,000	10,000
ICH mixedwood management guidebook				20,000	10,000
Harvesting practices in partial cutting regimes in boreal mixedwoods	20,000	10,000			
Harvesting practices in partial cutting regimes in sub-boreal mixedwoods			20,000	20,000	10,000
Regeneration of Sw in partial cutting – BWBS	20,000	10,000			
Regeneration of Sl in partial cutting – SBS, ICH			20,000	20,000	10,000
New guidebook subtotals	**60,000**	**45,000**	**55,000**	**95,000**	**40,000**
Totals	270,000	279,000	165,000	185,000	60,000

Tactic 2	Workshops, Tours and Decision Support Tools

Tactical Summary:

The increasing focus on biological diversity and ecological processes has stimulated interest in mixedwood forest management. The policies, practices, and information bases in BC do not, however, adequately support existing approaches to mixedwood management. Currently in the boreal and sub-boreal mixedwood areas, knowledge and experience in evaluating the effects of silviculture and forest management decisions on stand and landscape dynamics and function are uncertain, both from a biological and an socio-economic perspective.

Status:

Some mixedwood management extension activities have been undertaken over the past ten years but mainly on an ***ad hoc*** basis. Thus, there has been little planning (i.e., needs, development) and co-ordination for these activities. There have also been no established continuing education and training objectives for mixedwood managers and management programs. Most of the extension activities have centered around field trips/tours and workshops. The current decision support tools for mixedwood management in northeastern BC require updating.

Tactical Objectives:

The objective of these extension activities is ensure that current information and the results of research projects are brought to the end-user in a timely and appropriate manner.

Tasks, Deliverables, Targets and Milestones (Tactical):

Refer to Table 3.8.3 a) and b) for recommended scheduling and estimated costs of these initiatives:

Workshops:

Mixedwood succession and productivity.

Application of models to mixedwood stand management decisions, including the cost-effectiveness of treatments.

Site productivity concepts for the BWBS, SBS, and ICH.

Definitions of mixedwood.

Landscape-level modelling workshop, Fort Nelson; reviewing models for stand- and landscape-level applications in the BWBS.

Landscape-level modelling workshop, Prince George; reviewing models for stand- and landscape-level applications in the SBS and ICH.

Mixedwood management and certification.

Field tours:

Participation in field tours/activities outside BC

Long-term PSPs and research/demonstration sites to view growth responses of mixedwood stands to silvicultural regimes.

Impacts of mechanical site preparation on long-term soil productivity in boreal and sub-boreal mixedwood environments.

Decision Support Tools:

Boreal Select CD – summarising current information for the BWBS

Sub-Boreal Select CD – summarising current information for the SBS, ICH

Cost Sharing

In-kind contributions comprise the bulk of the investment to date, particularly from Ministry of Forests research and operations staff, and industry operations staff. In-kind-contributions have not been included in the estimates of investment required because a great deal of the work is comprised of development, writing, production and publication activities requiring additional (outside) staff resources. There will be contributions-in-kind of time from agency and company staff in terms of participating in the delivery of the field tours and workshops (e.g., providing sites, providing information, speaking). Until the specific nature of the workshops and field tours has been described, it is difficult to estimate the size of the contributions-in-kind.

Partnerships:

The partners in this project are the Ministry of Forests, the forest companies, the University of Northern BC, northern forestry consultants, and the Northern Forest Research and Extension Partnership. There will be commitments of staff time from the partners in support of the delivery of these extension services.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
250 000	10	215 000	265 000	295 000	65 000	105 000	945 000	5

Table 3.8.3 a) Recommended Delivery Schedule for Mixedwood Extension Tactic 2.

Extension Deliverable	2002/03	2003/04	2004/05	2005/06	2006/07
Workshops					
Mixedwood succession and site productivity concepts – BWBS	▨	▨			▨
Mixedwood succession and site productivity concepts – SBS		▨	▨		
Mixedwood succession and site productivity concepts – ICH		▨	▨		
Application of models to mixedwood stand management decisions – BWBS	▨	▨	▨	▨	▨
Application of models to mixedwood stand management decisions – SBS			▨	▨	▨
Application of models to mixedwood stand management decisions – ICH			▨	▨	▨
Definitions of mixedwood – BWBS	▨				
Definitions of mixedwood – SBS	▨				
Definitions of mixedwood – ICH	▨				
Landscape-level modelling in boreal mixedwoods, Fort Nelson	▨		▨		▨
Landscape-level modelling in sub-boreal mixedwoods, Prince George		▨	▨		▨
Mixedwood management and certification – BWBS	▨	▨			
Mixedwood management and certification – SBS and ICH		▨	▨		
Field tours					
Participation in field tours/activities outside BC	▨	▨	▨	▨	▨
Growth responses of mixedwood stands to silvicultural regimes-BWBS	▨	▨	▨	▨	▨
Growth responses of mixedwood stands to silvicultural regimes-SBS			▨	▨	▨
Growth responses of mixedwood stands to silvicultural regimes-ICH			▨	▨	▨
Impacts of MSP on long-term soil productivity - BWBS	▨				
Impacts of MSP on long-term soil productivity - SBS	▨				
Extension projects					
Boreal Select – synthesis of existing mixedwood management information, BWBS	▨				
Sub-Boreal Select – synthesis of existing mixedwood management information, SBS		▨	▨		
Sub-Boreal Select – synthesis of existing mixedwood management information, ICH		▨	▨		

Table 3.8.3 b) Estimated Costs for Mixedwood Extension Tactic 2

Extension Deliverable	2002/03	2003/04	2004/05	2005/06	2006/07
Workshops					
Mixedwood succession and site productivity concepts – BWBS	20,000	15,000			10,000
Mixedwood succession and site productivity concepts – SBS		20,000	15,000		
Mixedwood succession and site productivity concepts – ICH		20,000	15,000		
Application of models to mixedwood stand management decisions – BWBS	30,000	10,000	10,000	10,000	10,000
Application of models to mixedwood stand management decisions – SBS			30,000	10,000	10,000
Application of models to mixedwood stand management decisions – ICH			30,000	10,000	10,000
Definitions of mixedwood – BWBS	15,000				
Definitions of mixedwood – SBS	10,000				
Definitions of mixedwood – ICH	10,000				
Landscape-level modelling in boreal mixedwoods, Fort Nelson	15,000		15,000		15,000
Landscape-level modelling in sub-boreal mixedwoods, Prince George		35,000	15,000		15,000
Mixedwood management and certification – BWBS	10,000	10,000			
Mixedwood management and certification – SBS and ICH		10,000	10,000		
Workshop subtotals	**110,000**	**120,000**	**140,000**	**30,000**	**70,000**
Field tours					
Participation in field tours/activities outside BC	20,000	20,000	20,000	20,000	20,000
Growth responses of mixedwood stands to silvicultural regimes-BWBS	5,000	5,000	5,000	5,000	5,000
Growth responses of mixedwood stands to silvicultural regimes-SBS			5,000	5,000	5,000
Growth responses of mixedwood stands to silvicultural regimes-ICH			5,000	5,000	5,000
Impacts of MSP on long-term soil productivity - BWBS	10,000				
Impacts of MSP on long-term soil productivity - SBS	10,000				

Field tour subtotals	**45,000**	**25,000**	**35,000**	**35,000**	**35,000**
Extension projects – decision tools					
Boreal Select – synthesis of existing mixedwood management information, BWBS	60,000				
Sub-Boreal Select – synthesis of existing mixedwood management information, SBS		60,000	60,000		
Sub-Boreal Select – synthesis of existing mixedwood management information, ICH		60,000	60,000		
Decision tool subtotals	**60,000**	**120,000**	**120,000**		
Totals	**215,000**	**265,000**	**295,000**	**65,000**	**105,000**

ISSUE 9: LACK OF SPECIFIC PEST MANAGEMENT DECISION SUPPORT TOOLS

Overview Description of the Regional Strategic Issue:

The forests of central and northern BC are ageing. Wildfire as a disturbance agent has effectively been removed from these forest landscapes, and insects are taking over as the dominant agents of natural disturbance. Climate change is also likely contributing to the very rapid increase in forest pests and this pattern is likely to increase, not diminish, in the foreseeable future. In the Prince George, Robson Valley, Mackenzie and Quesnel Timber Supply Areas (TSAs), much (75-85%) of the annual harvesting program is determined by insects (pine, spruce, Douglas-fir and balsam bark beetles, and 2-year budworm). Some Forest Districts (e.g., Vanderhoof) and forest companies (Plateau Forest Products Ltd., Slocan Group) are striving to have their entire annual harvest comprised of insect-killed wood.

Mountain pine beetle (MPB) has reached epidemic proportions in seven Forest Districts in central BC (Vanderhoof, Lakes, Morice, Quesnel, Horsefly, Williams Lake, and Fort St. James), with approximately six million hectares and 50 million cubic metres of timber affected. The spruce bark beetle (SB) is nearly epidemic in three districts (Fort St. James, Prince George and Mackenzie), and the western balsam bark beetle (WBBB) is increasing in the Fort St. James, Mackenzie and Robson Valley Forest Districts.

In addition to the insects that attack maturing and old forests, root rot fungi (Tomentosus, Annosus, Laminated Root Rot, and Rhizina Root Rot) are also of concern. There is risk that management practises may exacerbate the natural distribution and spread of these root pathogens. Regenerating stands can also be affected by pests, e.g., weevils (white pine weevil, lodgepole pine weevil, and Warren's collar weevil), and lodgepole pine stem rusts (western gall rust, comandra blister rust, and stalactiform blister rust).

Thus, forest health concerns in the central interior are dominated by questions of how to deal most effectively with the threats to our current timber inventory, and how to deal with potential threats to future timber value, both on the existing inventory and on our regenerating inventory. Management strategies must be designed at the landscape level in order to minimise the incidence and impacts of old forest pest epidemics. Forest management interventions that alter forest level species composition and age-class distribution may as important as stand level silvicultural practices. This will require an unprecedented approach to landscape planning and management. Comprehensive and focussed research is needed to meet this enormous and complex stewardship challenge. A vitally important investment must be made in the generation of new knowledge to enable us to effectively deal with outbreaks when they occur and, more importantly, to diminish the likelihood that they will occur in future.

In the Omineca-Peace Region the following information and knowledge is required to address the pest management decision support issue:

greater understanding of the role that natural disturbance plays in shaping the structure of the forest and forest landscapes;

more information and knowledge of the ecology, population dynamics and successional dynamics of forest insects and diseases;

better use of existing knowledge and experience, particularly applied to the development of pest management decision-support tools;

solutions to current and future forest health/pest management issues are long-term, and involve decisions and actions impacting all forest resources, and all phases of forest management; and

solutions to current and future forest health/pest management issues must also consider the socio-economic impacts on forest-resource-dependent communities, and must be integrated with long-term community economic development plans.

Some of the questions raised relating to forest pests and their management are listed below.

(a) Bark Beetles

Mountain Pine Beetle:

What mechanism(s) is/are involved for the MPB to grow from endemic to epidemic levels? We cannot predict when outbreaks will occur without this knowledge.

How can we improve our understanding of MPB dispersal, e.g., length and timing of flights?

Is there a biological control for the MPB?

What are the relationships between the MPB life cycle and ambient temperatures?

What is the response of MPB to large-scale disturbance?

What are the post-harvest biodiversity and ecosystem productivity implications of salvage and sanitation harvesting on the scale necessary to deal with the current epidemic?

Are there reliable remote sensing methods for early detection of MPB attack?

What are appropriate hauling and milling strategies

Prevention versus control methods

Spruce Beetle:

Management guidelines for large expanses of same age class of one predominant species; landscape-level strategies?

What are appropriate hauling and milling strategies?

SB management strategy for parks and protected areas?

What are appropriate and effective debris disposal strategies?

Are there reliable remote sensing methods for early detection of SBB attack?

Effectiveness of prevention versus control methods?

SB-proofing guidelines?

Reliability of walkthroughs?

Effectiveness of hazard/risk/susceptibility rating systems?

What is the state of knowledge of control and management techniques; district and company practices?

Douglas-fir Beetle:

What is the state of knowledge of control and management techniques; district and company practices?

Need a proven standard hazard/risk/susceptibility rating system

Efficacy of current control techniques?

MSMA-type chemical available/possible?

Western Balsam Bark Beetle:

Need a proven standard hazard/risk/susceptibility rating system

What is the state of knowledge of control and management techniques; district and company practices?

Efficacy of current control techniques?

Life cycle picture incomplete

Effective detection methods available?

(b) 2-Year Budworm

Hazard rating for defoliators- what level of impact is high? Medium? Low?

Hazard rating for stands with more than one pest problem such as budworm and beetle.

What age stands is the budworm in?

Is canopy position of the tree important?

How bad will it be in plantations in the future?

Is there a relationship between the 2-year budworm and the WBBB?

(c) White Pine Weevil

Need a proven standard hazard/risk/susceptibility rating system for all five districts

Historical information on weevil incidence; examine plantations 6-30 years of age for incidence of attack

Determine effects of stand structure, overstory and stand density on weevil incidence

Implications of weevil management practices on free-growing guidelines and stocking standards

(d) Lodgepole Pine Rusts

Standard hazard/risk rating system at the stand and landscape levels.

Timber supply impacts of hard pine stem rusts.

Progeny testing for Pl susceptibility to infection.

Acceptable management practices.

Ecology of the pathogens.

Natural disturbance and Pl regeneration.

(e) Root Rots

Incomplete knowledge of occurrence, extent, and seriousness

Thought to be a serious issue already and will become worse because of our management practices

Impacts on growth and yield require further modelling (TASS ROT SIM, PROGNOSIS) and analysis

Need improved survey methods and training

Relationship to Sustainable Forest Management:

The Maintenance of Environmental Values

In the areas affected by pest epidemics, the environmental values most at risk are biodiversity, identified wildlife, soil productivity, riparian and wetland ecosystems, and watershed integrity. Better knowledge of:

- the role that natural disturbance plays in shaping the structure of the forest and forest landscapes;
- the biology and ecology of forest pests;
- the requirements for integrated pest management; and
- pest responses to forest management activities and treatments will increase our capability to reduce the risk to the above environmental values.

The Sustainability of Timber Resources

At the present time, bark beetles are having a major impact on short-term timber supply, by determining what, when and where we are harvesting throughout much of the Sub-Boreal Spruce Zone in the Omineca-Peace Region. Cut levels are being elevated to try and deal with the abundance of beetle-killed wood available. Companies are being asked/forced to operate in non-traditional territories. Harvest planning and landscape unit planning are next to impossible in the affected areas. The most significant risk is whether or not the concentration on salvage/sanitation harvesting of beetle-killed wood will compromise long-term timber supply and the economic stability of the forest industry and the local communities. This risk can be mitigated by:

- a capability to predict pest responses to forest management activities and treatments;
- identification and testing of methods to minimise pest epidemics in the future through more effective forest management strategies, plans and practices; and
- development of tools to minimise pest epidemics in the future through improved aerial detection.

The Sustainable Use of Non-timber Resources

The non-timber resources most at risk are:

- botanical forest products,;
- game species;
- furbearers;
- recreation and tourism; and
- forest soils.

To reduce the risks to these resources, we require:

- greater understanding of the role that natural disturbance plays in shaping the structure of the forest and forest landscapes;
- better knowledge about how these resources respond to disturbances, including large-scale harvesting; and
- better predictive capacity about the impacts of large-scale salvage/sanitation harvesting on forest productivity.

Relationship to Strategic Resource Plans and Decisions:

Strategic Decisions:

The results of this series of knowledge strategies will be readily applicable to the on-going reviews of the impacts of salvage/sanitation harvesting on the TSAs, and will be highly relevant to TSR III.

Strategic Resource Plans:

The results of this series of knowledge strategies will, in the post-epidemic phase, facilitate the development and implementation of new resource use plans that account for the substantive removal of beetle-killed wood.

Cross Reference to Management Unit Issues:

The results of the knowledge strategies for this issue will enhance the timber supply analyses undertaken in the Prince George, Mackenzie and Robson Valley TSAs. The results will also be applicable to the development of sustainable forest management plans for various other management units, e.g., IFPAs and EFMPPs.

Implementing these knowledge strategies would be most effective through working partnerships amongst all the stakeholders concerned with integrated pest management in the various management units.

Status of Existing Knowledge:

The status of knowledge concerning this issue is distinctly pest specific, and is presented at the Knowledge Strategy and Tactic level of this plan.

Recommended Knowledge Solution:

General Approach:

Operations and planning staff interviewed during this gap-analysis agreed that there is a general lack of pest management decision-making tools available to deal with the range of forest health issues facing land managers now and in the future. The following general approach to resolving this problem is recommended:

Conduct a literature and industry state-of-knowledge review and a critical evaluation of all operational and experimental pest management tools which currently exist in the province and adjacent relevant jurisdictions;

Investigate new inventory methods in BC (e.g., VRI, PEM, TEM), and their utility in addressing information required to control forest pest agents.

Current pest management strategies and practices for each forest district, with recommendations for future strategies and practices/treatments.

Review and evaluate the current pest management strategies and tactics for each forest district, and recommend future improvements where required.

Immediately implement strategies and tactic required to address the most urgently required data, information and knowledge requirements.

Specific Solutions:

Details are presented at the Strategic, Tactical and Project levels of this plan.

Relationship to other SSFM Knowledge Strategies

Knowledge Strategies and Tactics addressing this issue have either direct or indirect relationships with all other issues in this RMP.

Issue #1: Current forest inventories in the Omineca-Peace Region are old, especially in the context of forest health and stands that have been impacted by pests. Thus, the accuracy and reliability of these inventories to assess successional dynamics and to make future predictions of forest health conditions are uncertain. It is essential that the data (both spatial and attribute) are complete and current to support forest health management within each management unit.

Issues #2, 3, 4 and 7: When forest pests achieve epidemic levels on a vast scale, as we have seen in the southern parts of the Vanderhoof and Lakes Forest Districts, other forest resources can be impacted severely. Information about forest health management is important for the development of a caribou management decision model, models or strategies with respect to species at risk, and fish or wildlife habitat decision models.

Issue #5: In the Omineca-Peace Region, there is still inadequate understanding of the role that natural disturbance plays in shaping the structure, distribution, and productivity of the forested landscape. Our knowledge of successional dynamics for pest-impacted stands is incomplete, preventing meaningful productivity assessments and projections.

Issue #6: Sustainable Forest Management is a structured process of deduction aimed at selecting and implementing the most appropriate management actions for a specific forest estate. With forest insect pests driving the harvesting programs in several interior TSAs, forest health information is critical when designing and testing effective decision-support tools.

Issue #8: Mixed species management may provide some realistic, cost-effective solutions to particular forest pest concerns, especially some related to productivity of young stands (e.g., lodgepole pine rusts). Mixed species options may also provide some opportunity to develop preventative strategies for forest pests that attack older stands (e.g., bark beetles). A better understanding of forest successional dynamics may offer solutions to forest health issues.

Issue #10: Use of alternative harvesting methods is considered a potentially valuable solution to some of the spatial harvesting challenges inherent in forest health management. Wider-scale implementation and adaptive management experience with alternative silviculture systems is required, especially in areas (species, age-class distribution, stand structure) in which forest health issues are important.

Issue #11: While forest health issues per se may not have a direct connection to archaeological values and interests, how we choose to manage forest health may have a substantive impact on archaeological and heritage resources.

Issue #12: Forest pests, and the management responses to them, can cause large-scale disturbances and, as such, can cause serious degradation of visual resources.

Issue #13: As agents of forest renewal, forest pests have a profound effect on forest productivity and on timber supply.

Strategic Performance Indicators, Targets & Milestones:

Strategic performance indicators vary by strategy. Specific information is provided in the descriptions of each strategy and tactic.

Strategy 1: Management of Bark Beetles

Status of Existing Knowledge:

The following is a discussion of the knowledge gaps associated with each major species of bark beetle in the Omineca-Peace Region. It includes a list of key questions and information needs, grouped by knowledge application and perceived relative priority (based on the nature of the knowledge gap and the importance of the technical information). The highest priority sub-issues in this list form the basis for the recommended tactics that follow.

Mountain Pine Beetle

In BC, the Forest Practices Code Bark Beetle Management Guidebook prescribes a system of strategies and tactics that should be employed in the event of an infestation. There is a need to test the relative merits of the various possible combinations of strategies and related tactics. For example, MPBSim could be used to test the full range of strategies and tactics to deal with MPB management in the current epidemic conditions, and in future stand and landscape conditions.

As part of the review proposed above, the current susceptibility and risk rating systems/models for MPB should be evaluated in a range of beetle population levels (including epidemic levels), stand and landscape conditions, and management scenarios for north-central BC.

Many of the new protected areas and parks in north central BC are predominantly forested. There is the potential of some of these areas being refugia for MPB during endemic levels and sources of MPB when conditions favour epidemic outbreaks. This has occurred recently with the MPB outbreak in west central BC. Policies relating to natural disturbances in parks and protected areas need to be re-evaluated.

There is some uncertainty around debris disposal, hauling and milling strategies for beetle-infested wood. Current legislation and practices in BC and in other jurisdictions should be reviewed, and recommendations made for changes/improvements in existing legislation and strategies, and for operational trials to test new strategies and practices.

It is imperative that work continues on the TSA MPB strategic bark beetle management plans in place. The strategic plans were developed to manage current and future bark beetle infestations, and select strategies are used to identify action plan activities based on the level of these infestations. BMUs have been delineated in each Forest District within the TSA (Prince George, Vanderhoof, and Fort St. James), and strategies and tactics have been applied to each. BMUs are based on the beetle infestation status and other land use objectives. The next phase of the strategic plan should involve clarifying treatment targets and areas of responsibility for each BMU. An annual review of the strategies in the plan should be undertaken to assess the plan's success and how it may be improved to better meet its objectives and principles.

Improvements of the susceptibility and risk indices will occur as the accuracy and precision of the forest inventory files improve, and as ground sampling is conducted to further test and refine the indices. It is vital that basal area information be included in inventory programs.

The two major elements necessary for successful detection of green stage MPB attacks using remote sensing tools are: first, to be able to identify the large pine stems, within an image of a forest, that are potential targets for MPB attack; and, second, actual detection of green stage MPB attacks. A comprehensive problem analysis of the application of remote sensing technology is required as prerequisite for further research on this potentially valuable detection method.

Knowledge Gaps - High Priority:

MPB Dispersal:

MPB rates of spread and dispersal are not understood well enough to plan harvesting schedules effectively and efficiently.

What is the variability in length and timing of MPB flights?

MPB Early Detection:

There is an urgent need to develop an effective and efficient means of detecting early infestation (green stage of stress) by MPB.

A rigorous research and development initiative is required to evaluate remote sensing technology.

Quality of MPB-killed wood:

What is the rate of degradation in wood quality?

Management Practices:

Establish operational trials to test new strategies and practices for debris disposal, hauling and milling of beetle-infested wood.

Monitoring:

Mountain Pine Beetle flight: timing and patterns (length of flights) need to be monitored and documented.

Planning:

Continued development and implementation of the strategic MPB management plans for Prince George and Mackenzie TSAs.

Knowledge Gaps - Medium Priority:

Extension:

Fundamental training for new foresters – basic MPB biology and ecology; best management strategies and practices for a range of MPB population levels (including epidemic levels), stand and landscape conditions, and management scenarios; field tours.

Continuing education for practising field foresters and planners – course(s) in best management strategies and practices for a range of MPB population levels (including epidemic levels), stand and landscape conditions, and management scenarios.

Planning:

Evaluation of policies relating to managing natural disturbances in parks and protected areas.

MPB Biology/Ecology:

What are the relationships between the MPB life cycle and ambient temperatures?

What are the mechanism(s) involved at the endemic level that cause the beetle populations to reach epidemic levels? We cannot predict when and where outbreaks will occur unless we have a more thorough understanding of these mechanisms.

Better documentation of the biology and ecology of MPB is required for northern environments.

What is the response of MPB to large-scale disturbance?

Knowledge Gaps - Low Priority:

Extension:

Adequacy and efficacy of MPB-proofing guidelines.

Management Impacts:

What are the post-harvest biodiversity and ecosystem productivity implications of salvage and sanitation harvesting on the scale necessary to deal with the current epidemic.

Spruce Beetle

There is a need to improve the Safranyik and Shore (1999) susceptibility and risk rating system and to apply it to a greater range of sites and conditions. This improvement can occur only if the accuracy and precision of the forest inventory files improve, and as ground sampling is conducted to further test and refine the system.

Improvements of the SB susceptibility and risk indices will occur as the accuracy and precision of the forest inventory files improve, and as ground sampling is conducted to further test and refine the indices. It is vital that basal area information be included in inventory programs.

There appears to be potential also for the Reynolds **et al.** (1994) model to be adapted to interior BC conditions and spruce species. The major limitation again appears to be the quality of the BC inventory data

It is imperative that work continues on the TSA SB strategic bark beetle management plans in place. The strategic plans were developed to manage current and future bark beetle infestations, and select strategies are used to identify action plan activities based on the level of these infestations. BMUs have been delineated in each Forest District within the TSA (Prince George, Vanderhoof, and Fort St. James), and strategies and tactics have been applied to each. The next phase of the strategic plan should involve clarifying treatment targets and areas of responsibility for each BMU. An annual review of the strategies in the plan should be undertaken to assess the plan's success and how it may be improved to better meet its objectives and principles.

Improvements of the SB susceptibility and risk indices will occur as the accuracy and precision of the forest inventory files improve, and as ground sampling is conducted to further test and refine the indices. It is vital that basal area information be included in inventory programs.

Knowledge Gaps - High Priority:

SB Dispersal:

SB rates of spread and dispersal are not understood well enough to plan harvesting schedules effectively and efficiently.

Analysis:

Review, test and refine the Reynolds Spruce Beetle model.

Planning:

Continued development and implementation of the strategic SBB management plans for districts in the Prince George TSA.

Knowledge Gaps - Medium Priority:

SB Biology/Ecology:

What are the mechanism(s) involved at the endemic level that cause the beetle populations to reach epidemic levels? We cannot predict when and

What environmental or population factors influence the population fluctuations every 5-10 years?

Quality of SB-killed wood:

What is the rate of degradation in wood quality?

Monitoring:

SB flight: timing and patterns (length of flights) need to be monitored and documented, as well as rates of spread.

Extension:

Fundamental training for new foresters – basic SB biology and ecology; best management strategies and practices for a range of SB population levels (including epidemic levels), stand and landscape conditions, and management scenarios; field tours.

Continuing education for practising field foresters and planners – course(s) in best management strategies and practices for a range of SB population levels (including epidemic levels), stand and landscape conditions, and management scenarios.

Adequacy and efficacy of SB-proofing guidelines, and ground-truthing walkthroughs.

Knowledge Gaps - Low Priority:

Management Impacts:

What are the post-harvest biodiversity and ecosystem productivity implications of salvage and sanitation harvesting on the scale necessary to deal with SB epidemics?

Douglas Fir Beetle

Much of the information available for use in susceptibility and risk rating systems comes from the USA where many of the conditions differ from those in BC. Thus, as BC information becomes available, further work will be required to refine Shore and Safranyik's (1999) susceptibility and risk rating system.

It is imperative that work continues on the TSA DFB strategic bark beetle management plans in place. The strategic plans were developed to manage current and future bark beetle infestations, and select strategies are used to identify action plan activities based on the level of these infestations. The next phase of the strategic plan should involve clarifying treatment targets and areas of responsibility for each Beetle Management Unit. An annual review of the strategies in the plan should be undertaken to assess the plan's success and how it may be improved to better meet its objectives and principles.

Improvements of the susceptibility and risk indices will occur as the accuracy and precision of the forest inventory files improve, and as ground sampling is conducted to further test and refine the indices. It is vital that basal area information be included in inventory programs.

Knowledge Gaps - High Priority:

DFB Dispersal:

DFB rates of spread and dispersal are not understood well enough to plan harvesting schedules effectively and efficiently.

What is the variability in length and timing of DFB flights?

Management Practices:

Establish operational trials to test new strategies and practices for debris disposal, hauling and milling of beetle-infested wood.

Analyses/Plans:

Continued development and implementation of the strategic DFB management plan for the Prince George TSA.

Knowledge Gaps - Medium Priority:

Quality of DFB-killed wood:

What is the rate of degradation in wood quality?

What are the effects of site conditions, stand age and stand density on degradation of wood quality?

Potential uses and markets for DFB-killed wood?

Planning:

Continued development and implementation of the strategic DFB management plans for districts in the Prince George TSA.

Inventory:

Improvements in forest inventory files and refinement of infestation susceptibility indices are needed.

DFB Biology/Ecology:

Better documentation of the biology and ecology of DFB is required for northern environments.

Monitoring:

Douglas-fir Beetle flight: timing and patterns (length of flights) need to be monitored and documented, as well as rates of spread.

Extension:

Fundamental training for new foresters – basic DFB biology and ecology; best management strategies and practices for a range of DFB population levels (including epidemic levels), stand and landscape conditions, and management scenarios; field tours.

Continuing education for practising field foresters and planners – course(s) in best management strategies and practices for a range of DFB population levels (including epidemic levels), stand and landscape conditions, and management scenarios.

Extension Notes: Adequacy and efficacy of DFB-proofing guidelines.

Western Balsam Bark Beetle

It is imperative that work begins on a Prince George TSA WBBB strategic management plan. The strategic plan should be developed to manage current and future bark beetle infestations, and select strategies should be used to identify action plan activities based on the level of these infestations. The first phase in the plan should be to develop Beetle Management Units. The next phase of the strategic plan should involve clarifying treatment targets and areas of responsibility for each BMU. An annual review of the strategies in the plan should be undertaken to assess the plan's success and how it may be improved to better meet its objectives and principles.

Development and improvement of the susceptibility and risk indices will occur as the accuracy and precision of the forest inventory files improve, and as ground sampling is conducted to further test and refine the indices. It is vital that basal area information be included in inventory programs. We have very poor inventories of WBBB-affected stands and no tools to detect those stands.

Knowledge Gaps - High Priority:

Analysis/Plans:

Because there are no current susceptibility and risk assessment tools, and as more information becomes available, develop susceptibility and risk rating system(s) for WBBB.

Development and implementation of the strategic WBBB management plan for the Prince George TSA.

WBBB Biology/Ecology:

Better documentation of the biology and ecology of WBBB is required for northern environments.

Describe the WBBB life cycle (basic biology) various biogeoclimatic zones and subzones (especially the ESSF, upper SBS, and the ICH).

Knowledge Gaps - Low Priority:

Inventory:

Improvements in forest inventory files and refinement of infestation susceptibility indices fare needed.

WBBB Dispersal:

Initiate project(s) to study the rates of spread and dispersal of WBBB.

Determine the variability in length and timing of WBBB flights.

Management Practices:

Establish operational trials to test new strategies and practices for debris disposal, hauling and milling of beetle-infested wood.

Adequacy and efficacy of WBBB-proofing guidelines, and ground-truthing walkthroughs.

Initiate trials testing new landscape- and stand-level strategies/practices for prevention of the spread of WBBB.

Quality of WBBB-killed wood:

Determine the rate of degradation in wood quality.

Identify the effects of site conditions, stand age and stand density on degradation rate of wood quality.

Determine potential alternative uses and markets for WBBB-killed wood.

WBBB Biology/Ecology:

What are the mechanism(s) involved at the endemic level that cause the beetle populations to reach epidemic levels? We cannot predict when and where outbreaks will occur unless we have a more thorough understanding of these mechanisms.

Effects of WBBB-caused tree mortality on stand characteristics, site quality, and ecotype.

Strategic Summary:

This knowledge strategy addresses the highest priority knowledge gaps associated decision support for bark beetle management in the Omineca-Peace Region.

A review of current debris disposal, hauling and milling strategies for bark-beetle-infested wood, and current legislation and practices in BC and in other jurisdictions, together with research recommendations for changes/improvements in existing legislation and strategies, and for operational trials to test new strategies and practices.

Development of a proven remote sensing tool for successful detection of green stage MPB and SB attacks.

Effective, proven, and user-friendly tools for susceptibility and risk rating for all the bark beetles.

Better understanding of the biology, ecology and movement of the Western balsam bark beetle.

Status:

The tactics making up this strategy are new, but based on progress from past research and development. Successful implementation of this initiative will, however, require acceleration of the research effort in order to resolve the many gaps in the knowledge base.

Strategic Objectives:

To undertake research and development tactics that address the highest priority knowledge gaps concerning bark beetle decision support.

Tasks, Deliverables, Targets and Milestones (Strategic):

Specific tasks, deliverables, targets and milestones are presented at the Tactical and Project levels of this plan.

Tactic 1	Mountain Pine Beetle Decision Support

Status of Knowledge:

Organisation, Synthesis and Analysis:

Some decision support tools to deal with MPB issues are available from the Pacific Forestry Centre in Victoria. Two such tools are:

A mountain pine beetle infestation model (MPBSim)

Methods of mountain pine beetle management involve early detection combined with direct control measures such as logging infested stands, treating single infested trees and spacing stands to prevent beetle population build-up. Managers need strategies and tactics to deal with the problem. In BC, the Forest Practices Code Bark Beetle Management Guidebook prescribes a system of strategies and tactics that should be employed in the event of an infestation. However, there is a need to test the relative merits of the various possible combinations of strategies and related tactics. MPBSim allows managers to assess the relative effectiveness of various treatments. MPBSim can use actual stand host and beetle data collected from samples or inventory databases, or the model can generate a host stand from general stand attributes. The stand structure (generated or measured) can be interactively edited to reflect updated inventory conditions or to assess the possible effects of changes in stand conditions.

Mountain pine beetle decision support system

The mountain pine beetle decision support system provides an impact simulation for estimating stand losses due to mountain pine beetle attack, and susceptibility and risk rating models which are used to prioritise stands for preventative treatments. The impact simulation (called MPBSim) simulates a mountain pine beetle attack on a stand of any size and tree species composition, and allows the user to explore the projected losses to the stand given different management scenarios.

Some field staff interviewed believe that susceptibility and risk rating systems are not necessarily working well where the beetle populations are extremely high. Pest specialists confirm the fact that these systems are not designed for use in epidemic situations.

Those Forest Districts within the Omineca/Peace area currently affected by the MPB have developed strategic plans and decision-making tools to meet their needs.

Strategic Bark Beetle Management Plan for the Prince George Timber Supply Area

The vision of this plan is to reduce the non-recoverable losses and long and short-term timber disruptions due to bark beetles on the communities and resources within the Prince George TSA. The beetle program will be conducted to obtain an acceptable balance of environmental, social and economic risks. The strategic plan was developed to manage current and future bark beetle infestations, and select strategies are used to identify action plan activities based on the level of these infestations. BMUs have been delineated in each Forest District within the TSA (Prince George, Vanderhoof, and Fort St. James), and strategies and tactics have been applied to each. BMUs are based on the beetle infestation status and other land use objectives. The next phase of the strategic plan will involve clarifying treatment targets and areas of responsibility for each BMU. An annual review of the strategies in the plan is proposed to assess the plan's success and how it may be improved to better meet its objectives and principles.

Strategic Bark Beetle Management Plan for the Mackenzie Timber Supply Area

The vision of this plan is to reduce the non-recoverable losses and long and short-term timber disruptions due to bark beetles on the communities and resources within the Mackenzie TSA. The beetle program will be conducted to obtain an acceptable balance of environmental, social and economic risks. The strategic plan was developed to manage current and future bark beetle infestations over a long-term planning horizon. An essential element of the strategic plan is the bark beetle priority rating systems which operationalise the strategies set in each Beetle management unit (BMU). The next phase of the strategic plan will involve clarifying performance thresholds, treatment targets, and areas of responsibility. An annual review of the strategies in the plan is proposed to assess the plan's success and how it may be improved to better meet the goals for forest health management in the TSA.

Mackenzie Bark Beetle Analysis Technical Guide

The main functions of the bark beetle analysis system are proximity and risk rating for MPB, and timber volume infestations. The outputs of the system are five summary tables for volume infestation, and one table with proximity and stand risk-rating results for MPB. The most common information provided in the first five summary tables is the gross volume, infested volume, deductions (environmental, landscape, merchantability), net volume, net infested volume, and area (ha) for different tree species groups.

Fort St. James District Bark Beetle Strategic Plan

This strategic plan provides rationale for local changes to the Prince George TSA strategic plan for bark beetle management. Included are amendments to bark beetle management strategies and BMU boundaries where required; determinations of areas of responsibilities for forest health activities for licensees and the Forest Service; and development of a consistent bark beetle tracking system for the district.

Other high-profile activities associated with the MPB issue, and which have information and knowledge management as integral components, include:

CLMA/NFPA Mountain Pine Beetle Emergency Task Force -To lessen the effects of the MPB epidemic to the greatest extent possible, industry has formed this task force to work with government in battling the MPB in BC's working forest. Licensees on the front lines of the infestation are re-directing up to 100% of their allowable annual cut (AAC) to beetle management in an attempt to leap ahead of the infestation. The view taken is that the most effective way to combat the beetles is to harvest the numerous small patches that have beetles still resident in the trees.

BC Government Caucus Northern Mountain Pine Beetle Task Force -This caucus toured the central interior, visiting affected communities and listening to public presentations from large and small industry, local politicians, and the general public. Their goal is to produce a report, to the Minister of Forests by September 15, 2001, with recommendations for government action.

West Central BC Mountain Pine Beetle Strategic Business Recommendations Report – prepared by R.S. Rogers Consulting Firm (not available at the time of this draft).

Regional Community Economic Development and Management Committee - The mayors of Fraser Lake, Vanderhoof, and Fort St. James have formed the Regional Community Economic Development and Management Committee (RCEDMC). This committee will work with industry, agencies, ministries, and concerned community members to assist in the mitigation of the far-reaching effects of the MPBB infestation in the Prince George, Quesnel, and Lakes TSAs. The function of the Committee is to provide a focal point for economic development and forest management and a communication link for the many organisations, agencies and regional communities.

Resource Inventory:

Our inventory database is inadequate to provide the support necessary for effective pest management. As an example, basal area information is required before hazard-rating tools can be most effective.

There has been some initial research with remote sensing tools over the past several years in the Omineca-Peace Region. All attempts to date have not resulted in a suitable means of detecting, at the operational scale required, first year infestations while trees are in the "green stage" of stress symptoms. A review of efforts to date, and an overall problem analysis should be undertaken before further research of this potential method of remote detection is resumed.

Extension:

Extensive MPB information is available from several sources: Ministry of Forests, Canadian Forest Service, US Forest Service, UBC, UNBC, SFU, and the CLMA/NFPA Mountain Pine Beetle Emergency Task Force. Entomologist of the Ministry of Forests regional have been heavily involved in dealing with the MPB epidemic issue and have contributed a substantive amount of time to extension activities.

Research:

Most MPB research has been done south of Riske Creek. Is the southern information transportable to north central BC, and are the models based on the southern information valid in the north?

There appear to be no candidates as biological controls for the MPB.

Monitoring:

This function is performed annually via "detailed" and "overview" aerial sketch mapping, as well as though various types of ground surveys.

Tactical Summary:

Status:

New and ongoing

Tactical Objectives:

Tasks, Deliverables, Targets and Milestones (Tactical):

Project 1	Infestation Rate-of-Spread Research

Project Summary:

Mountain pine beetle (MPB) rates of spread from: 1) large diameter bucking waste, 2) infested logs in transit and 3) from log decks in mill yards are not well understood. Some data has been collected and analysed but more in-depth research is required.

The rate of degradation of wood quality in MPB-killed trees in B.C. is not well understood.

This Project is designed to investigate MPB rate of spread dynamics under the situations noted.

Project Status:

New

Project Objectives:

Assess MPB spread rates from # 1 - 3 above under various conditions and locations.

Assess the degradation of wood quality in MPB-killed trees under various conditions and locations.

Project Tasks, Deliverables, Targets and Milestones:

Assess rates of spread during - Summers of 2002 & 2003

Compile and analyse data - Winter 2003

Develop guidelines for managing MPB from # 1 – 3 - by Spring 2003

Assess degradation of wood quality - Summers of 2002 - 2004

Compile and analyse data - Winter 2004- 2005

Develop guidelines for managing wood deterioration - by Spring 2005

Cost Sharing

Forestry Canada and MoF

Partnerships:

Forestry Canada and MoF

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	100 000	50 000		350 000	4

Project 2	Early Detection Remote Sensing Problem Analysis

Project Summary:

This project consists of a comprehensive problem analysis designed to:

Review the extensive literature on remote sensing detection of stressed forests, and particularly national and international experience in early detection of tree stressing insects.

Develop recommendations for research project(s) designed to address MPB infestation detection in the Omineca-Peace Region

Design rigorous scientific protocols for subsequent research initiatives.

Project Status:

New

Project Objectives:

To conduct a comprehensive problem analysis of the application of remote sensing technology to early detection of MPB;

To design an effective research program, projects and experimental protocol for MPB remote sensing investigations.

Project Tasks, Deliverables, Targets and Milestones:

Complete the problem analysis by May, 2002 in order that recommendations for research action are considered for implementation during the next infestation cycle of the pest.

Cost Sharing

Forestry Canada, MoF and Industry Licensees

Partnerships:

Forestry Canada, MoF and Industry Licensees

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000					50 000	1

Project 3	Early Detection Remote Sensing Research

Project Summary:

This project(s) will implement the highest priority recommendations of Tactic 2 (Problem Analysis)

Project Status:

New

Project Objectives:

To develop a cost-effective, operationally compatible remote sensing application for the early detection of MPB

Project Tasks, Deliverables, Targets and Milestones:

To be determined by recommendations from Tactic 2

Cost Sharing

Forestry Canada, MoF and Industry Licensees

Partnerships:

Forestry Canada, MoF and Industry Licensees

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		200 000	200 000	50 000	50 000		4	500 000

Tactic 2	Spruce Beetle Decision Support

Status of Knowledge:

Organisation, Synthesis and Analysis:

Those Forest Districts within the Omineca/Peace area currently affected by the SB have developed strategic plans and decision-making tools to meet their needs:

Strategic Bark Beetle Management Plan for the Prince George Timber Supply Area

The vision of this plan is to reduce the non-recoverable losses and long and short-term timber disruptions due to bark beetles on the communities and resources within the Prince George TSA. The beetle program will be conducted to obtain an acceptable balance of environmental, social and economic risks. The strategic plan was developed to manage current and future bark beetle infestations, and select strategies are used to identify action plan activities based on the level of these infestations. BMUs have been delineated in each Forest District within the TSA (Prince George, Vanderhoof, and Fort St. James), and strategies and tactics have been applied to each. BMUs are based on the beetle infestation status and other land use objectives. The next phase of the strategic plan will involve clarifying treatment targets and areas of responsibility for each BMU. An annual review of the strategies in the plan is proposed to assess the plan's success and how it may be improved to better meet its objectives and principles.

Strategic Bark Beetle Management Plan for the Mackenzie Timber Supply Area

The vision of this plan is to reduce the non-recoverable losses and long and short-term timber disruptions due to bark beetles on the communities and resources within the Mackenzie TSA. The beetle program will be conducted to obtain an acceptable balance of environmental, social and economic risks. The strategic plan was developed to manage current and future bark beetle infestations over a long-term planning horizon. An essential element of the strategic plan is the bark beetle priority rating systems which operationalise the strategies set in each Beetle management unit (BMU). The next phase of the strategic plan will involve clarifying performance thresholds, treatment targets, and areas of responsibility. An annual review of the strategies in the plan is proposed to assess the plan's success and how it may be improved to better meet the goals for forest health management in the TSA.

Mackenzie Bark Beetle Analysis Technical Guide

The main functions of the bark beetle analysis system are proximity and risk rating for MPB, and timber volume infestations. The outputs of the system are five summary tables for volume infestation, and one table with proximity and stand risk-rating results for MPB. The most common information provided in the first five summary tables is the gross volume, infested volume, deductions (environmental, landscape, merchantability), net volume, net infested volume, and area (ha) for different tree species groups.

Fort St. James District Bark Beetle Strategic Plan

This strategic plan provides rationale for local changes to the Prince George TSA strategic plan for bark beetle management. Included are amendments to bark beetle management strategies and BMU boundaries where required; determinations of areas of responsibilities for forest health activities for licensees and the Forest Service; and development of a consistent bark beetle tracking system for the district.

Safranyik and Shore (1999)[9] have developed a SB susceptibility and risk rating system along the lines of the system they developed for the MPB (Shore and Safranyik 1992).[10] Their approach considers the short-term risk of loss to a stand as a function of both stand susceptibility and beetle population pressure. The parameters utilised in the system include:

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[9] Safranyik, L. and T.L. Shore. 1999. A susceptibility and risk rating system for the spruce beetle ***Dendroctonus rufipennis***. Version 5, April 21, 1999. Unpubl. 8 p.

[10] Shore, T.L. and L. Safranyik. 1992. Susceptibility and risk rating systems for the mountain pine beetle in lodgepole pine stands. Forestry Canada, Pacific and Yukon Region, Victoria, BC. Inf. Rep. BC-X-336. 12 p.

characteristics related to stand susceptibility:

site quality,

stand age,

stand density (growth rate),

percentage susceptible spruce basal area, and

stand location, i.e., elevation., latitude, longitude, and aspect; and

characteristics related to beetle population pressure:

standing infested trees,

windthrow,

logging, and

fire history.

An earlier version of the SB system (1996) was evaluated (Brackely **et al.** 1997)[11] and its validity confirmed. The model found: a positive relationship between increasing susceptibility and increasing attack intensity; a direct relationship between attack intensity and percent spruce volume in the stand; an inverse relationship between attack intensity and elevation; and a positive relationship between intensity of attack and site quality. This system/model will enable harvesting programs to be more proactive and directed to stands in the heavier susceptibility classes which have a higher potential for damage. Improvements of the index will occur as the accuracy and precision of the forest inventory files improve, and as ground sampling is conducted to further test and refine the index (Brackely **et al.** 1997).

Reynolds **et al.** (1994)[12] developed a knowledge-based decision-support system for SB management in Southeast Alaska. This system provides recommendations for reducing SB hazard and risk to spruce stands. Hazard is defined as the amount to stand damage expected to occur as the result of a SB outbreak and is typically measured in units of basal area, volume, or numbers of affected individuals. Hazard is also thought of as a measure of stand susceptibility to attack. Hazard is expressed as percentage of spruce basal area killed by SBs 5 to 10 years after the start of an outbreak in a stand, and is predicted in terms of various site and stand factors. Because stand conditions which affect hazard change relatively slowly, hazard predictions are useful for developing strategic plans for forest-wide treatment schedules. Inventory data required for hazard classification are total stand basal area (m^2/ha), percentage of stand basal area in spruce, and percentage of spruce basal area in trees with a 25-cm dbh. Site data required are elevation (m), and slope aspect (degrees).

In this model, risk is a measure of the likelihood, or probability, that an outbreak will occur and is usually expressed as a proportion (e.g., a risk value of 1.0 is a certain event). Risk is predicted in terms of hazard as well as the size of the available SB population. SB populations are, in turn, affected by the availability of breeding materials and weather conditions, both of which may change markedly from year to year. Because the size of a SB population, and, therefore, also the associated risk, may change rapidly over a few years, reliable predictions of SB risk can be made for only 2 to 3 years. Risk predictions are, thus, most useful for short-term tactical planning at the early stages of an outbreak. Stand hazard and maximum density of windthrown trees (stems per ha) are the two most important factors determining risk of a SB outbreak. Other factors to consider are: size of SB populations in adjacent or nearby stands, daily ambient air temperature in the past June, and total rainfall in the past summer.

There appears to be potential for the Reynolds **et al.** (1994)[13] model to be adapted to interior BC conditions. The major limitation appears to be the quality of the BC inventory data.

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[11] Brackley, A., S.P. Taylor, and T.L. Shore. 1997. Evaluation of stand susceptibility rating system for the spruce beetle in British Columbia. Proc. 11th Ann. Symp.GIS, Vancouver, BC. Pp. 83-88.

[12] Reynolds, K.M., E.H. Holsten, and R.A. Werner. 1994. SBexpert users guide (version 1.0): a knowledge-based decision-support system for spruce beetle management. Gen. Tech. Rep. PNW-GTR-345. USDA Forest Service, PNW Res. Sta., Portland OR. 72 p.

[13] Reynolds, K.M., E.H. Holsten, and R.A. Werner. 1994. SBexpert users guide (version 1.0): a knowledge-based decision-support system for spruce beetle management. Gen. Tech. Rep. PNW-GTR-345. USDA Forest Service, PNW Res. Sta., Portland OR. 72 p.

Resource Inventory:

Our inventory database is inadequate to provide the support necessary for effective pest management. As an example, basal area information is required before hazard-rating tools can be most effective.

There has been some initial research with remote sensing tools over the past several years in the Omineca-Peace Region. All attempts to date have not resulted in a suitable means of detecting, at the operational scale required, first year infestations while trees are in the "green stage" of stress symptoms. A review of efforts to date, and an overall problem analysis should be undertaken before further research of this potential method of remote detection is resumed.

Extension:

Substantive amounts of SB information are available from several sources: Ministry of Forests, Canadian Forest Service, US Forest Service, UBC, UNBC, and SFU. Ministry of Forests regional entomology staff have been heavily involved in dealing with SBB concerns over the past 15 years, and have contributed a substantive amount of time to extension activities.

Research:

A recent (1997) local research initiative investigated the emergence of spruce beetles from hibernation, and its implications to operational sanitation harvesting (FRBC/MoF Research Project; R. Hodgkinson)

Monitoring:

This function is performed annually via "detailed" and "overview" aerial sketch mapping, as well as though various types of ground surveys.

Tactical Summary:

Spruce beetle rates of spread from: 1) standing trees, 2) large diameter bucking waste, 3) infested logs in transit, and 4) from log decks in mill yards are not well understood. Some data has been collected and analysed but more in-depth research is required.

There is no effective spread model for spruce beetle emerging from standing trees. The Reynolds et al. (1994) system from Alaska should be appropriately modified and tested in B.C.

The ability to detect spruce beetle attacks remotely is not possible until at least 18 months has elapsed.

Status:

New and ongoing

Tactical Objectives:

Assess spread rates from # 1 - 4 above under various conditions and locations.

Modify and test the Reynolds et al. (1994) system in B.C.

Evaluate remote sensing technology (based on MPB problem analysis and research protocol) on spruce beetle in the year of attack.

Tasks, Deliverables, Targets and Milestones (Tactical):

Assess rates of spread Summers of 2002 & 2003

Compile and analyse data Winter 2003

Develop guidelines for managing MPB from # 1 - 3 Spring 2003

Modify and test Reynold's system Summers of 2002 & 2003

Make modified Reynold's system functional for general use by fall of 2004

Test CASI Late Summers of 2002 & 2003

Compile and analyse data Winter 2003 - 2004

Develop guidelines for using CASI for spruce beetle detection Spring 2005

Cost Sharing

Forestry Canada, MoF

Partnerships:

Forestry Canada, MoF

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		450 000	450 000	150 000	50 000		1 100 000	4

Tactic 3	Douglas Fir Beetle Decision Support

Status of Knowledge:

Organisation, Synthesis and Analysis

Douglas-fir is not a major species in the Omineca-Peace Region in terms of the volume cut, but it is an important species ecologically, and it is an important economic species in several locales. The Fort St. James Forest District is the only district at this time in which the DFBB is a pest of major concern in north-central BC, and the District has a strategic plan and decision-making tools to help meet their needs.

Strategic Bark Beetle Management Plan for the Prince George Timber Supply Area

The vision of this plan is to reduce the non-recoverable losses and long and short-term timber disruptions due to bark beetles on the communities and resources within the Prince George TSA. The beetle program will be conducted to obtain an acceptable balance of environmental, social and economic risks. The strategic plan was developed to manage current and future bark beetle infestations, and select strategies are used to identify action plan activities based on the level of these infestations. BMUs have been delineated in each Forest District within the TSA (Prince George, Vanderhoof, and Fort St. James), and strategies and tactics have been applied to each. BMUs are based on the beetle infestation status and other land use objectives. The next phase of the strategic plan will involve clarifying treatment targets and areas of responsibility for each BMU. An annual review of the strategies in the plan is proposed to assess the plan's success and how it may be improved to better meet its objectives and principles.

Strategic Bark Beetle Management Plan for the Mackenzie Timber Supply Area

Fort St. James District Bark Beetle Strategic Plan

This strategic plan provides rationale for local changes to the Prince George TSA strategic plan for bark beetle management. Included are amendments to bark beetle management strategies and BMU boundaries where required; determinations of areas of responsibilities for forest health activities for licensees and the Forest Service; and development of a consistent bark beetle tracking system for the district.

Adjacent areas of DFB concern in the Vanderhoof Forest District are very similar or identical to those in Fort St. James, and can be managed according to the strategies outlined in the documents referred to above.

Shore and Safranyik (1999) produced a draft (working version) susceptibility and risk rating system for the DFB in BC. The authors defined stand susceptibility as the characteristics of a stand which make it inherently susceptible to damage by a DFB epidemic should a population of the insect arise in the stand. The variables included are:

Age (in years of the dominant/co-dominant Douglas-fir component): <80 years – low; >150 years – very high.

Diameter (cm) (average diameter of the Douglas-fir component ≥ 25.0 cm in the stand): < 29 cm – low; >40 cm – high.

Growth rate (mm) (last 10 years growth): >19 mm – low;< 11 mm – high.

Stand purity (% of total stand basal area composed of Douglas-fir.

Shore and Safranyik (1999) defined stand risk as the likelihood of damage occurring in a stand, and as a function of both the stand susceptibility characteristics and beetle population levels. A stand can have high susceptibility but have little risk of loss if there is no nearby sizeable DFB population. In the 1999 version of the risk rating system, factors affecting tree vigour e.g., age, drought, competition, disease, or defoliation) are assumed to be accounted for in the susceptibility index in the measurement of growth rate. Factors which influence the magnitude of beetle populations are stand conditions (e.g., standing infested trees), and the presence and abundance of preferred breeding materials (e.g., wind- and snow-break, windfall, and logging debris).

The susceptibility and risk rating indices are intended to be used in tandem. The susceptibility index provides a relative indicator of which stands would experience the most loss in the event of a DFB infestation. The risk index provides an index of the short-term expectation of tree mortality in a given stand as a result of a DFB infestation.

Further research and development is required to refine this system because of climatic and environmental differences between BC and the USA, where much of the DFB information originates.

Resource Inventory:

Our inventory database is inadequate to provide the support necessary for effective pest management. As an example, basal area information is required before hazard-rating tools can be most effective.

There has been some initial research with remote sensing tools over the past several years in the Omineca-Peace Region. All attempts to date have not resulted in a suitable means of detecting, at the operational scale required, first year infestations while trees are in the "green stage" of stress symptoms. A review of efforts to date, and an overall problem analysis should be undertaken before further research of this potential method of remote detection is resumed.

Extension:

Information on the DFB is available from several sources: Ministry of Forests, Canadian Forest Service, UBC, and UNBC. Regional Entomologist of the Ministry of Forests have been involved in dealing with DFB concerns over the past 15 years, and have contributed a substantive amount of time to extension activities.

Research:

Monitoring:

This function is performed annually via "detailed" and "overview" aerial sketch mapping, as well as though various types of ground surveys.

Tactical Summary:

Douglas-fir beetle (DFB) rates of spread from: 1) large diameter bucking waste, 2) infested logs in transit and 3) from log decks in mill yards are not well understood. Some data has been collected and analysed but more in-depth research is required.

The rate of degradation of wood quality in DFB-killed trees in B.C. is not well understood.

Status:

New

Tactical Objectives:

Assess DFB spread rates from # 1 - 3 above under various conditions and locations.

Assess the degradation of wood quality in DFB-killed trees under various conditions and locations.

Tasks, Deliverables, Targets and Milestones (Tactical):

Assess rates of spread Summers of 2002 & 2003

Compile and analyse data Winter 2003

Develop guidelines for managing DFB from # 1 - 3 by Spring 2003

Assess degradation of wood quality Summers of 2002 - 2004

Compile and analyse data Winter 2004- 2005

Develop guidelines for managing wood deterioration by Spring 2005

Cost Sharing

Forestry Canada, MoF

Partnerships:

Forestry Canada, MoF

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	100 000	50 000		350 000	4

Tactic 4	Western Balsam Bark Beetle Decision Support

Status of Knowledge:

Organisation, Synthesis and Analysis:

Little information exists provincially in terms of WPBB hazard, risk, or susceptibility rating systems, or WBBB management strategies and plans.

Resource Inventory:

Our inventory database is inadequate to provide the support necessary for effective pest management. As an example, basal area information is required before hazard-rating tools can be most effective.

Extension:

Little information is available for WBBB in BC.

Research:

Monitoring:

This function is performed annually via "detailed" and "overview" aerial sketch mapping, as well as though various types of ground surveys.

Tactical Summary:

This tactic is designed to resolve the knowledge gap concerning the biology, ecology and infestation dynamics of the Western balsam bark beetle in order to support the development of a suitable risk decision support tool.

Status:

The biology and ecology of western balsam bark beetle (WBBB) in various biogeoclimatic zones and subzones (especially the ESSF, upper SBS and ICH) is not well understood.

There is no susceptibility and risk assessment tool for WBBB in B.C.

Tactical Objectives:

Examine the biology and ecology of the WBBB in the biogeoclimatic zones and subzones (as above).

Develop a susceptibility and risk assessment tool for WBBB in B.C.

Tasks, Deliverables, Targets and Milestones (Tactical):

Examine the biology and ecology of the WBBB	Summers of 2002- 2004
Produce extension note on WBBB biology & ecology	Winter 2004-2005
Develop susceptibility and risk assessment tool for WBBB	Winter 2004-2005

Cost Sharing

Forestry Canada, MoF

Partnerships:

Forestry Canada, MoF

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		80 000	80 000	80 000	50 000		240 000	3

Strategy 2: Management of Hard Pine Stem Rusts

Status of Existing Knowledge:

Organisation, Synthesis, Analysis:

The Pine Stem Rust Management Guidebook was published in 1996. It describes procedures, practices and results based on research, local experience and generally accepted principles. The purpose of the guidebook is to help users exercise their professional judgement in developing site specific management strategies. The Prince George Region Standard Operating Procedures for the Detection and Assessment of Pine Stem Rusts published in 2000 provides clarification of detection and assessment procedures based on recent studies of survey methods. The standardised detection methodology provided the basis for the regional pine stem rust hazard procedure that is currently being developed in the Vanderhoof and Mackenzie Forest Districts. The purpose of the hazard rating system is to identify the key predictive variables that are responsible for high rust incidence in young regenerated stands of lodgepole pine. A secondary component of these projects, it to test and develop a procedure to adjust the Operational Adjustment Factor 1 (OAF1) for infected stands based on a field based survey.

Some companies are applying different tactics to minimise the impact of infection on planted Pl. Fraser Lake Sawmills, for example, is planting a mix of Pl and interior spruce, to varying degrees on different site series. They are also increasing the stocking levels on sites where the risk of rust infection is judged to be high. Fraser Lake Sawmills is also trying an innovative approach to boosting stocking. They're testing direct spot seeding (3-5000 seeds/ha) in an effort to reduce the cost of established higher stocking.

Although the province's free-growing guidelines are perceived to be a problem by some licensees, the development of hazard zones will provide them with better definition of where to expect severe rust incidence. This will reduce the uncertainty associated with not knowing where to implement tactics for minimising rust impacts

Resource Inventory:

The quality of inventory information is not a big issue, unless we are talking about rust incidence collected by silviculture surveyors. The incidence information currently residing ISIS is generally highly unreliable.

Extension:

Several sites that are useful for demonstration exist within the Prince George Forest Region. Unpublished results exist for some and are presented on tours of these sites.

Research:

It is well known that there is tremendous genetic diversity in resistance to pine stem rusts. A recent study[14] provided clear evidence of Pl family variation in susceptibility to CBR infection. Variation among families was highly significant and observed family infection rates ranged from 0% to 69% of trees infected. The author suggested that opportunities exist for screening families for rust susceptibility, and for creating custom seed lots for high risk planting sites.

The impacts of hard pine stem rusts on timber supply are not well documented for BC. Woods **et al.** (2000)[15] suggested that lodgepole pine stands in the central interior would suffer greater losses from hard pine stem rusts than stands in the southern interior. They also predicted that losses due to CBR would be at least as high as those previously reported for WGR and SBR[16]. Woods et al. (2000) were the first to predict future volume loss through to rotation, due to the presence of hard pine stem rusts. They used the predicted volume results derived from the growth and yield model TASS to estimate the impacts of CBR and WGR. They found that, in stands in which both CBR and WGR were present, CBR has a far greater impact on volume that WGR. They also reported that volume losses due to hard pine stem rusts in Pl-dominated stands are as high as 7.2% by culmination age. The authors point out that the magnitude of these losses warrants more attention being paid to these diseases during silvicultural treatments (e.g., stand density treatments).

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[14] John, S.E.T. 2001. Variation among lodgepole pine families in susceptibility to comandra rust infection. Unpbulished report.

[15] Woods, A.J., A. Nussbaum, and B. Golding. Predicted impacts of hard pine stem rusts on lodgepole pine dominated stands in central British Columbia. Can. J. For. Res. 30: 476-481.

[16] Van der Kamp, B.J. Unpublished data.

Research in the Prince George Forest Region includes:

volume impacts analysis on a 1968 est. lodgepole pine espacement trial (EP671);

remote sensing of pine stem rusts using CASI (compact airborne spectrographic imager);

hazard rating and TSA impacts in the Vanderhoof and Mackenzie forest districts; and

cultural control of pine stem rusts.

EP 671, also known as the Dog Creek Espacement Trial, is the oldest, well designed, highly infected lodgepole pine espacement trial in the province. The unpublished results from the 30th year assessment of EP 671 show that the average rust incidence for all 24 plots was about 50% stem infections. One of the most significant results is that rust incidence is not affected by initial espacement levels of 6, 8, 10, and 12 feet. This result is similar to the earlier assessment of the three EP 660 sites (a different 'old' espacement trial with three different levels of espacement of lodgepole pine). This trial is providing long term rate of mortality information for each of the three pine rusts (WGR, CBR, SBR). At the 30th year assessment, just over 50% of the CBR stem-infected trees had died, compared to just over 20% of the WGR stem-infected trees. Extrapolation of the 30-year rust-specific mortality curves was used to predict individual tree mortality, allowing a more accurate modelling of impacts through TASS. Height-of-stem-infection curves were created for all three rusts. A severity measure (percent circumference girdled) is measured for each rust infection every 5 years to provide a rust species-specific and espacement-specific rate of stem girdling.

A remote sensing trial using CASI imagery was evaluated on the EP 671 site, using approximately 600 trees. The testing showed that there was promise, but that further testing was required. No confusion matrix was generated and as a result, no measure of success was reported.

The hazard-rating project is a first of it's kind. The initial testing was conducted over a two-year period on West Fraser's operating area in Fraser Lake. The initial results indicated that there is a strong relationship between elevation and rust incidence. Rust incidence decreased steadily with increasing elevation. Presence of alternate host is important for incidence of CBR. Testing was expanded to the entire Vanderhoof district in year 2000. The inclusion of an OAF1 study in 2000 will provide information to test whether we can adjust OAF1 based on a ground-based survey. This OAF1 study will provide a breakdown of all sources of unstocked areas by causal agent. The OAF1 methodology is based on a ground based survey developed by Forest Practices Branch, Victoria, BC.

The hazard-rating project was initiated in the Mackenzie forest district in 1999, and will be completed in March 2002. The results of the first year's surveying (50 randomly selected stands) showed that, once again, elevation was the most significant factor in predicting rust incidence. The Mackenzie study also includes the OAF1 adjustment study. The initial results indicate that the average total stocking was 3000 stems per hectare and that the average OAF1 was around 10%. This is 5% lower than the provincial default value of 15% using in TIPSY generated yield curves. More testing and analysis will determine how well these initial results hold up.

Two official demonstration areas were established in 2000 to demonstrate testing of cultural control techniques. The purpose of the trial is to test and demonstrate a cultural control treatment for recruiting infected stems and enabling the achievement of free growing on otherwise NSR sites. The Bowron plot in the Prince George District primarily demonstrates WGR branch infection pruning and stem infection excision. This is the first known trial of stem excision with WGR. The purpose of the trial is to determine the reduction in rust impact through direct cultural control. There is approximately 40% rust infection. Over 600 sph were treated; time will tell how many stems are "cured" as a result of treatment. The Mackenzie plot has 70% infection resulting in approximately 450 free-growing stems. Enough trees were treated to bring this site well past free growing. Initial analysis with TASS showed a 50% increase in volume as a result of treatment.

Monitoring:

Monitoring work is planned for:

the recently established Realised Genetic Gain trial sites in the Prince George Region. These sites will provide an opportunity to make measurements at the initial expression of infection symptoms;

Fraser Lake Sawmills' seedling fertilisation trial at 112 km of the Holy Cross FSR. This trial is designed to test the effect of early nutritional status on seedling infection level; and

Bowron Progeny trial site.

Strategic Summary:

Resource Inventory:

Conduct audit of rust information collected in silviculture surveys.

Extension:

Research:

This Strategy consists of 6, integrated research and development tactics, which, if fully implemented, will resolve all of the high priority knowledge gaps concerning hard pine stem rusts.

Standard hazard/risk rating system at the stand and landscape levels.

Develop pine stem rust hazard and risk rating systems for usage at the stand and landscape levels based on current projects in the districts and other available and relevant information. Test and improve the hazard and risk rating systems.

Monitor the progress of the rust hazard rating system development in Vanderhoof and Mackenzie Forest Districts and the OAF1. Assist when and where required in the development and implementation phases. Continue current projects developing hazard rating at district and TSA landscape level.

Analyse the problem the licensees have with regard to the lack of guidance for free-growing and stocking standards in rust-infected plantations. Prepare a report for regional review and implementation

Assess other districts and TSA's for the need for hazard rating

Evaluate timber supply impacts of pine stem rusts:

Analyse the impact work conducted in the Mackenzie TSA, and the Vanderhoof district to determine whether further work is required for the other districts/TSA's in the Region.

Analyse OAF1 ground based survey methodology to determine whether it gives comparable results to TASS and TIPSY

Progeny testing for Pl susceptibility to infection.

Undertake a complete screening program of hard pine stem rust susceptibility amongst all Pl families used in the provincial tree improvement program.

Work with MOF Tree Improvement Program and Vernon Seed Orchard Company to test susceptibility of current seed sources and select seed sources to hard pine stem rusts. If appropriate, produce seed selection guidelines for interior Pl regeneration.

Initiate trials comparing disease resistance between naturally regenerating Pl, seeded Pl, and planted Pl.

Best management practices.

Establish long-term trials testing the effects of:

stand density manipulation treatments on the incidence of rust infections (such as EP 671)

planting mixes and densities on the incidence of rust infections,

site preparation practices on rust survival (on the reduction of inoculum) and incidence, and on alternate host species (or co-operate with others who are installing site prep trials, i.e. L. Bedford's Bednesti Trial),

brushing treatments (including broadleaf retention) on rust incidence and impact.

Ecology of the pathogens:

Investigate the impacts of disturbance on the secondary hosts.

Investigate methods of control for the secondary hosts.

Investigate rate of mortality of infected stems over the long term

Investigate the frequency of rust inactivation, the causal agents, and the mitigating impacts

Natural disturbance and Pl regeneration

Undertake a literature review of the impacts of natural disturbance on natural regeneration of Pl. Evaluate information on: the effects of the nature and intensity of the disturbance; the areal extent of the disturbance; the effects of post-disturbance weather; germination success and survival rate; distribution of naturally regenerating Pl; early Pl growth rates; incidence and damage inflicted by hard pine stem rusts.

Survey a range of ages of naturally-disturbed sites; review disturbance history; record early Pl growth rates, stocking levels and distribution, and incidence and damage inflicted by hard pine stem rusts; and compare to similar information from plantations.

Establish comparative studies that examine rust incidence and severity of infection on naturally regenerated stock versus nursery seedlings.

Monitoring:

Evaluate the current seedling screening practices of nurseries to ensure nursery seedlings are not infected.

Monitor PSP's in the long-term research trials.

Monitor PSP's in operational trials.

Status:

The seven tactics making up this strategy are either new or the continuation of past and current research initiatives. Successful implementation of this initiative will, however, require acceleration of the research effort in order to resolve the many gaps in the knowledge base.

Strategic Objectives:

To undertake research and development tactics that address the highest priority knowledge gaps concerning hard pine stem rust decision support.

Tasks, Deliverables, Targets and Milestones (Strategic):

Organisation, Synthesis, Analysis:

By Year 4 (2005/06), have working stand- and landscape-level pine stem rust hazard and risk rating systems for the relevant TSA's (Prince George, Mackenzie).

By Year 3 (2004/05), have a regional policy with respect to pine stem rusts and stocking standards and free-growing guidelines.

Resource Inventory:

By year 3 (2004/05), have improved system for ensuring quality of rust incidence information.

Extension:

By Year 5 (2006/07):

12 Extension Notes based on research results, literature reviews, operational experience, and problem analyses.

Possible seed selection guidelines for interior Pl regeneration.

A series of demonstration sites utilised by resource managers, planners, policy-makers, stakeholders, and students interested in: the biology, ecology and successional dynamics of the hard pine stem rusts; the efficacy of preventative and remedial treatments; and Pl regeneration.

Research:

Projects which will result in:

increased understanding of the biology, ecology and successional dynamics of the hard pine stem rusts;

selection guidelines for usage of seed from rust-resistant families for interior Pl regeneration;

demonstrations of best practices to prevent significant losses to hard pine stem rusts;

demonstrations of most effective remedial treatments in stands which have been infected by the rusts;

long-term PSPs to monitor Pl growth and performance over the length of the rotation; and

better estimates of the timber supply impacts of the hard pine stem rusts.

Monitoring:

A network of PSPs to monitor Pl growth and yield and wood quality in response to rust infections, or in response to preventative and remedial treatments.

Five-year reporting on all long-term monitoring projects/programs.

Tactic 1	Stem Rust Hazard and Risk Rating

Status of Knowledge:

Refer to the Status of Knowledge (Strategy)

Tactical Summary:

A significant program exists currently in two districts. This same work needs to be extended to other districts and TSA's as appropriate.

Status:

At present two districts have substantial work completed to date. This work includes data collection, and some data summary, but no statistical analysis. Upon successful analysis of the data, hazard map generation will identify high hazard/risk areas.

Tactical Objectives:

To determine if there is sufficient relationships between site and ecological factors to warrant a hazard and risk rating system. The goal of these systems is to recommend appropriate silviculture systems in high hazard areas in order to minimise and avoid impacts due to pine stem rust caused tree mortality.

Tasks, Deliverables, Targets and Milestones (Tactical):

Identify other districts requiring surveys	Spring 2002
Conduct surveys	Spring 2002
Compile and analyse data.....	Winter 2002
Develop hazard rating system complete with silviculture regime recommendations	Summer 2003

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	100 000	100 000	100 000	500 000	5+

Tactic 2	Stem Rusts Impact on Timber Supply

Status of Knowledge:

Refer to the Status of Knowledge (Strategy)

Tactical Summary:

This tactic is designed to investigate the impacts of hard pine stem rust infections on tree growth (form, defect and vigour) and stand yields. Knowledge from this initiative will support the operational adjustments (netdowns) of lodgepole pine yield curves, thereby improving the biological reality of yield projections in pine forests.

Two complimentary projects are recommended to implement this tactic in the short term.

Status:

This tactic is an expansion of existing research underway in two management units.

Tactical Objectives:

To determine the impact of pine stem rusts on the timber supply.

Tasks, Deliverables, Targets and Milestones (Tactical):

Details are provided at the project level of this plan.

Project 1	Stem Rust Calibration of Growth and Yield Models

Project Summary:

Significant progress has occurred in two districts, but this same work is required in other districts.

Project Status:

At present data has been collected for two districts using the OAF1 ground based survey methodology. This data needs to be analysed and run through various models (TASS and TIPSY) in order to determine validity of the methodology and it's application.

Project Objectives:

To determine the impact of pine stem rusts on the timber supply. This involves collect data and analysing the data and determining the appropriateness of the methodology and it's application.

Project Tasks, Deliverables, Targets and Milestones:

Collect data in other districts	Spring 2002
Analyse data, write report	Winter 2002

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000	50 000	50 000	250 000	5+

Project 2	Stem Rust Monitoring

Status of Knowledge:

Refer to the Status of Knowledge (Strategy)

Tactical Summary:

Monitor existing trials and establish new ones as appropriate

Status:

Several trials require remeasurements or status updates, e.g. EP671 requires a 35 year remeasurement, Bednesti site prep trial requires a status update, and EP660 may require remeasurement. Establishment of new trials as deemed appropriate.

Tactical Objectives:

To collect knowledge on treatment response, rust impacts and provide demonstration opportunities

Tasks, Deliverables, Targets and Milestones (Tactical):

Collect data from trials

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		30 000	30 000	30 000			90 000	3

Tactic 3	Progeny Testing for Lodgepole Pine Susceptibility to Infection

Status of Knowledge:

Refer to the Status of Knowledge (Strategy)

Project Summary:

An extensive Pl progeny trial network exists in the field in high hazard zones. This network of trials needs to be evaluated and analysed statistically to evaluate the potential for screening for rust resistance.

Status:

At present only a small portion of one trial has been evaluated. All sites in high hazard areas should be evaluated.

Project Objectives:

To determine if there is sufficient variation in resistance to warrant screening for rust resistance in the orchards

Project Tasks, Deliverables, Targets and Milestones:

Describe Tasks, Deliverables, Targets and Milestones:

Develop evaluation methodology Spring 2002

Evaluate trials in the field Spring 2002

Compile and analyse data..... Winter 2002

Create strategy for utilising information Summer 2003

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		30 000	30 000	30 000			90 000	3

Tactic 4	Best Management Practices

Status of Knowledge:

Refer to the Status of Knowledge (Strategy)

Tactical Summary:

Determine the best management practices to address high priority operational stem rust management issues by conducting a problem analysis, including a review of the scientific literature, evaluation of existing trials, and integration with other activities listed within related tactics in this document.

Status:

No major activities or projects can be planned until a detailed problem analysis is completed, and until technical direction from hazard and risk ratings (Tactic 1) is clear.

Tactical Objectives:

Determine the highest priorities for research on this topic by identifying key issues for operational planning.

Tasks, Deliverables, Targets and Milestones (Tactical):

Conduct a comprehensive problem analysis.

Project 1	Problem Analysis and Research Recommendations

Status of Knowledge:

Refer to the Status of Knowledge (Strategy)

Project Summary:

Status:

Defer until the fifth year of the 5 year plan

Project Objectives:

Conduct a comprehensive problem analysis on best management practices to mitigate lodgepole pine stem rust impacts on second growth stands.

Project Tasks, Deliverables, Targets and Milestones:

Recommend interim best management practices approximately 4 years after initial results of Tactic 1 are completed.

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
						25 000	25 000	1

Tactic 5	Ecology of Pathogens

Status of Knowledge:

Refer to the Status of Knowledge (Strategy)

Tactical Summary:

Determine the best approach to address this sub-issue by conducting a problem analysis, including a review of the scientific literature, evaluation of existing trials, and integration with other activities listed within related tactics in this document.

Status:

No major activities or projects can be planned until a detailed problem analysis is completed, and until technical direction from hazard and risk ratings (Tactic 1) is clear.

Tactical Objectives:

Determine the highest priorities for research on this topic by identifying key issues for operational planning.

Tasks, Deliverables, Targets and Milestones (Tactical):

Details are provided at the project level of this plan.

Project 1	Problem Analysis and Research Recommendations

Status of Knowledge:

Refer to the Status of Knowledge (Strategy)

Project Summary:

Conduct a comprehensive problem analysis on the ecology of rust pathogens.

Status:

Defer until the fifth year of the five year plan.

Project Objectives:

ProjectTasks, Deliverables, Targets and Milestones:

Recommend research and development needs approximately 4 years after initial results of Tactic 1 are completed.

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
						25,000	25,000	5+

Tactic 6	Natural Disturbance and Pine Regeneration
Status of Knowledge: Refer to the Status of Knowledge (Strategy)	
Tactical Summary:	
Status:	
Tactical Objectives:	
Tasks, Deliverables, Targets and Milestones (Tactical): Details are provided at the project level of this plan.	

<table>
<tr><td>Project 1</td><td colspan="8">Problem Analysis and Research Recommendations</td></tr>
<tr><td colspan="9">Status of Knowledge:
Refer to the Status of Knowledge (Strategy)</td></tr>
<tr><td colspan="9">Project Summary:</td></tr>
<tr><td colspan="9">Status:</td></tr>
<tr><td colspan="9">Project Objectives:</td></tr>
<tr><td colspan="9">Project Tasks, Deliverables, Targets and Milestones:</td></tr>
<tr><td colspan="9">Cost Sharing</td></tr>
<tr><td colspan="9">Partnerships:</td></tr>
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<tr><td></td><td></td><td>25 000</td><td></td><td></td><td></td><td></td><td></td><td>5+</td></tr>
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Strategy 3: Management of Budworm

Tactic 1 Two-Year Budworm Hazard Rating Development

Status of Knowledge:

The following applied knowledge gaps were confirmed by client-group survey:

Hazard rating for defoliators- what level of impact is high? Medium? Low?

Hazard rating for stands with more than one pest problem such as budworm and beetle.

Tactical Summary:

This tactic is designed to provide an inventory of the historic and current incidence of 2-year budworm infestations to determine effects of stand age, composition and structure (horizontal and vertical) on budworm incidence and severity. The purpose is to determine if there is a sufficient relationship between site and ecological factors to warrant a hazard and risk rating system. We also need to know the spatial and temporal restrictions that are needed to prevent area-wide population increases.

The goal is to have 2-year budworm hazard rating maps for Prince George, Mackenzie and Robson Valley TSA's by the fall of 2003.

Status:

Ongoing- data has been collected from four Districts to date but is required in 2 others

Tactical Objectives:

To determine if there is sufficient relationships between site and ecological factors; and

To develop a suitable hazard and risk rating system;

Tasks, Deliverables, Targets and Milestones (Tactical):

Remeasure plots in existing districts and establish plots in remaining 2 districts Summer 2002

Remeasure all plots Summer 2003

Compile and analyse data Winter 2003

Develop hazard rating maps by 2003-2004 and an extension note on stand hazard rating

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		150 000	100 000	100 000			350 000	3

Tactic 2	Two-Year Budworm Management Research

Status of Knowledge:

The following applied knowledge gaps were confirmed by client-group survey:

What age stands is the budworm in?

Is canopy position of the tree important?

How bad will it be in plantations in the future?

Is there a relationship between the 2-year budworm and the WBBB?

Tactical Summary:

This tactic has multiple objectives: it is designed to re-evaluate first year infestation mapping methods to determine whether early detection of second year attack is feasible; It also addresses need for greater knowledge of the synecology of the organism to facilitate development of decision support for pest management.

Status:

New

Tactical Objectives:

To re-test whether mapping of defoliation in year 1 can be a successful indicator of defoliation in year 2. To achieve a better understanding of the effects that stand management practices have on the incidence, severity, and duration of budworm attacks, and thus produce better stand management guidelines; and

To produce an extension note on management strategies and practices which will reduce the likelihood of major 2-year budworm infestations and minimise the severity of infestations which do occur

Tasks, Deliverables, Targets and Milestones (Tactical):

Identify districts where management tactics will be employed Spring 2002

Conduct treatments 2002 - 2004

Compile and analyse data Winter 2004-05

Issue extension note outlining improved 2-year budworm management guidelines 2005

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	100 000	50 000		350 000	4

Strategy 4: Management of White Pine Weevil

Tactic 1	Weevil Hazard Rating Development

Status of Knowledge:

The following applied knowledge gaps were confirmed by client-group survey:

A proven standard hazard/risk/susceptibility rating system for all five districts

Historical information on weevil incidence; examine plantations 6-30 years of age for incidence of attack

Effects of stand structure, overstorey and stand density on weevil incidence

Implications of weevil management practices on free-growing guidelines and stocking standards

Tactical Summary:

This tactic is designed to develop white pine weevil hazard rating system for the Prince George, Mackenzie and alley TSA's

Status:

Data has been collected from two Districts to date but is required in 3 others (the remainder of the TSA).

Tactical Objectives:

An inventory of the historic and current incidence of weevil infestations in plantations 6 to 30 years of age to determine effects of stand structure, overstorey and stand density on weevil incidence and severity. To determine if there is sufficient relationships between site and ecological factors to warrant a hazard and risk rating system. We also need to know the spatial and temporal restrictions that are needed to prevent area-wide population increases.

The goal is to have weevil hazard rating maps for Prince George, Mackenzie and Robson Valley TSA's by the fall of 2003.

Tasks, Deliverables, Targets and Milestones (Tactical):

Identify other districts requiring surveys	Spring 2002
Conduct surveys	Summer 2002
Compile and analyse data...	Winter 2002

Develop hazard rating maps by 2003-2004

and an extension note on plantation/stand hazard rating, particularly pre-harvest.

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000	100 000	100 000			200 000	2

Strategy 5: Pest Management Extension

Tactic 1	Literature Review /Knowledge Assembly and Extension

Status of Knowledge:

Refer to Strategic knowledge gap priorities for each pest agent.

Specific extension initiatives concerning hard pine stem rust management include:

Prepare an Extension Note updating the Forest Pest Leaflet 37 for the Omineca/Peace and Skeena/Bulkley regions.

Prepare an Extension Note summarising licensees' practices to avoid or reduce rust infections.

Establish and document sites demonstrating best practices to avoid or reduce the impacts of pine stem rusts.

Establish operational trials as demonstration sites – demonstrate the efficacy of different practices in minimising and avoiding rust impacts.

Incorporate regional hard pine stem rust information into curriculum at UNBC, UBC, FMIBC, CNC, and OUC.

Prepare and deliver seminar on hard pine stem rusts and their impacts on Pl regeneration and timber supply.

Undertake a literature review of:

pine stem rust responses to management practices,

the relationship(s) of rust incidence to seedling condition (including presence of true needles) and physiological stress in seedlings (pre- and post-planting),

the relationship(s) between prescribed burning (including intensity of the burn) and rust incidence and severity of infection.

Tactical Summary:

This tactic is designed to improve the utility of the existing extensive knowledge base. A state of knowledge assembly, and design of an effective electronic and/or hardcopy extension medium will ensure clients in the Omineca-Peace Region with better access to decision support data, information and knowledge of pest management.

Status:

New

Tactical Objectives:

To conduct literature reviews resolving priority knowledge gaps; and

To design and implement an effective extension delivery medium for pest management knowledge

Tasks, Deliverables, Targets and Milestones (Tactical):

Conduct three priority literature reviews annually;

Design (or refine existing) information extension system(s) suitable for the pest management knowledge base.

Cost Sharing

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000	50 000	50 000	50 000	50 000	250 000	5+

ISSUE 10: LACK OF ALTERNATIVE HARVESTING EXPERIENCE

Overview Description of the Regional Strategic Issue:

Currently, there is a lack of knowledge and experience amongst the consulting and contracting communities in regards to operational alternative harvesting techniques such as partial cutting with cable systems. This lack of knowledge limits the abilities of planning and operational teams to effectively provide economical and manageable solutions to meet today's ever-changing dynamics to Sustainable Forest Management.

Using traditional harvesting methods, fall downs in AAC are anticipated in areas with visual sensitivity. Variations from traditional harvesting techniques are required to soften the reduction in AAC and provide the visual demands by the public. With the increased knowledge of alternative harvesting systems and their practicality these solutions could be targeted to assist with management of timber supply areas which are considered inoperable, unstable, moist ecotypes or visually sensitive. In today's forestry economy this variation from traditional directions is not always welcomed, as alternative harvesting techniques have not been proven to be economical. This regional issue has been brought forward to bridge the gap from the unknown to the familiar and proven.

Relationship to Sustainable Forest Management:

The Maintenance of Environmental Values

Increased alternative harvesting experience will promote the understanding and sustainable management of timber resources to provide workable solutions to maintain and protect ecosystems, meet VQO's and beetle proof susceptible stands.

The Sustainability of Timber Resources

With expanded knowledge of alternative harvesting techniques we will have better utilisation of existing timber supply in areas traditionally considered inoperable or not practical to harvest with traditional means. Better understanding of alternative techniques will help to provide a stable fibre supply for our local harvesting communities and sectors that rely on forest operations for a livelihood.

The Sustainable Use of Non-timber Resources

In regards to non-timber resources the risk is not providing a significantly increased knowledge base with alternative harvesting systems to promote awareness within all communities dealing with land base issues. Alternative harvesting systems can be a valuable tool to meet stand and landscape level biodiversity objectives, which benefit many Non-Timber Resources.

Relationship to Strategic Resource Plans and Decisions:

Strategic Decisions:

The results of this knowledge strategy will complement the activities of the regional LRMPs.

Cross Reference to Management Unit Issues:

The results of these knowledge strategies will supply new directions and support to timber supply analysis across the region. Also these results will support development of future activities amongst the regional management units such as, TSAs, IFPAs, and EFMPPs.

Status of Existing Knowledge:

The knowledge that exists varies within each district and is individualise with Licensees, contractors and district staff. There is no central location to access this information.

Recommended Knowledge Solution:

General Approach:

The recommended solution involves the following initiatives:

A literature review of all pertinent information and experience

An extension program designed around an Internet web page and/or hardcopy catalogue would be developed to house and disseminate information to the end users.

A series of operational scale experiments implemented within a number of key forest districts.

A monitoring and reporting function which will document and report on the results of the experiments.

Specific Solutions:

A detailed description is presented at the Strategic and Tactical levels of this plan.

Strategic Performance Indicators, Targets & Milestones:

Strategic performance indicators vary by strategy. Specific information is provided in Tactical descriptions. Refer to Table 3.10.1 for a detailed summary of delivery scheduling and estimated costs.

Relationship to other SSFM Knowledge Strategies

The recommended strategies are either directly or indirectly linked to the following other SSFM Issues in the RMP:

Issue 1 Unreliable Forest Resource Inventories:

Needs for improved inventories to allow for strategic planning of alternative harvesting decisions.

Issue 2 Incomplete Caribou Management Objectives

Issue 3 Lack of Species-at-Risk Management Objectives

Issue 4 Lack of General Wildlife Habitat Management Objectives

Issue 6 Inadequate SFM Decision Support Tools

Issue 7 Inadequate Fish and Fish Habitat Management Objectives

Issue 9 Lack of Specific Pest Management Decision Support Tools

Issue 12 Absent or Unreliable Visual Resource Inventories

Visual Landscape Inventory (VLI) needs to be current to establish Visual Quality Objectives (VQO).

Issue 13 Inadequate Understanding of Managed Stand Productivity Potential

Table 3.10.1 Strategic and Tactical Schedule and Estimated Costs

KNOWLEDGE STRATEGY Knowledge Tactic	District	2001-02 $	2002-03 $	2003-04 $	2004-05 $	2005-06 $	2006-07 $	Total $
ALTERNATIVE HARVESTING EXTENSION								
Knowledge Review	DRV	50000	10000					60000
	DJA	50000	10000					60000
Sub Total		*100000*	*20000*					*120000*
Alternative Harvesting Workshop	DPG			20000				20000
	DRV		20000					20000
	DJA		20000					20000
	DVA			20000				20000
	DMK			20000				20000
	DDC			20000				20000
	DJO			20000				20000
	DFN			20000				20000
Sub Total			*40000*	*120000*				*160000*
ALTERNATIVE HARVESTING PILOT STUDIES								
Operational Trials	DPG			85000	85000	40000	40000	250000
	DRV		85000	85000	40000	40000		250000
	DJA		85000	85000	40000	40000		250000
	DVA			85000	85000	40000	40000	250000
	DMK			85000	85000	40000	40000	250000
	DDC			85000	85000	40000	40000	250000
	DJO			85000	85000	40000	40000	250000
	DFN			85000	85000	40000	40000	250000
Sub Total			*170000*	*680000*	*590000*	*320000*	*240000*	*2000000*
Cost/Benefit Analysis Report	DPG				5000		5000	10000
	DRV			5000		5000		10000
	DJA			5000		5000		10000
	DVA				5000		5000	10000
	DMK				5000		5000	10000
	DDC				5000		5000	10000
	DJO				5000		5000	10000
	DFN				5000		5000	10000
Sub Total				*10000*	*30000*	*10000*	*30000*	*80000*
Monitoring	DPG					15000	15000	30000
	DRV				10000	10000	10000	30000
	DJA				10000	10000	10000	30000
	DVA					15000	15000	30000
	DMK					15000	15000	30000
	DDC					15000	15000	30000
	DJO					15000	15000	30000
	DFN					15000	15000	30000
Sub Total					*20000*	*110000*	*110000*	*240000*
Total Recommended Knowledge Investment Cost								**$2,600,000**

Strategy 1: Alternative Harvesting Extension

Tactic 1	Review of Alternative Harvesting Knowledge

Status of Knowledge:

The knowledge that exists varies within each district and is individuals with Licensees, contractors and district staff. There is no central location to access this information.

Tactical Summary:

The primary focus is to conduct an in depth literature/project review, categorise and catalogue the results, and establish a permanent library to bridge the knowledge gaps for alternative harvesting. This strategy will provide all districts and end users with a knowledge base catalogue to act as a support tool, that will be accessible to assist in strategy making decisions at regional and district levels.

Status:

New

Tactical Objectives:

To collect and compile, all the available information on alternative harvesting;

To disseminate this information to a broad audience for strategic planning; and

To identify operational constraints for specific areas (VQO, Operability, etc.).

Tasks, Deliverables, Targets and Milestones (Tactical):

Knowledge Review to be completed by March 31, 2002

Operational constraints review to be completed by March 31, 2002

To centrally locate the knowledge review to reduce duplication of data review and to create a product that would be accessible via the web by September 1, 2002.

Cost Sharing:

CanFor, Ft St James and Slocan, Valemount will jointly develop this activity through MYA allocations for 2001-2002.

Partnerships:

Potential partnerships with UNBC, CNC, MOF, MSRM, MWLAP, FERIC and Industry.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
100 000	1	20 000					20 000	1

Tactic 2	Alternative Harvesting Workshop

Status of Knowledge:

The knowledge that exists varies within each district and is individuals with Licensees, contractors and district staff. There is no central location to access this information.

Tactical Summary:

Terrain and local issues change from district to district; it will be essential to establish district workshops with the district focus taken in to account to maximise the benefits of operational trials. The workshops will build upon the local knowledge base and address knowledge deficiencies with District staff, licensee operations and local contractors.

Status:

New

Tactical Objectives:

To train contractors on equipment requirements and logging methodology of selective cable logging. To train layout staff, loggers, supervisors, planers, and foresters in effective methods to meet goals of selective cable logging.

Tasks, Deliverables, Targets and Milestones (Tactical):

Review existing course material and construct and or revise as necessary, an Alternative Harvesting course manual that would facilitate the framework for teaching alternative harvesting techniques to harvesting contractors, layout staff and other forestry staff.

Establish district workshops to enhance alternative harvesting experience.

Workshops would be phase 1 of any operational trials.

Cost Sharing:

Each workshop will be paid out of MYA funds for the particular parties involved.

Partnerships:

Potential partnerships with UNBC, CNC, MOF, MSRM, MWLAP, FERIC and Industry.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		40 000	120 000				160 000	2

Strategy 2: Alternative Harvesting Pilot Studies

Tactic 1 Implementation of Operational Trials

Status of Knowledge:

There has been some research conducted on small scales in various locations in the region. There is a need to deliver the results of those trials to a larger audience. Few documented trials of alternative systems exist. Experience varies throughout districts.

Tactical Summary:

The focus of the operational trials would be to experiment with different harvesting strategies and to provide a cost/benefit analysis for each strategy or technique explored. Monitoring would be conducted to ensure operational trial objectives are met.

Status:

New

Tactical Objectives:

To show contractors the capabilities of the equipment required for selective cable logging. To train layout, loggers, supervisors, planers, foresters in and effective method of selective cable logging to meet their goals.

Tasks, Deliverables, Targets and Milestones (Tactical):

Fort St James 2002 –2003

Robson Valley 2002-2003

Trial locations for the remaining districts will be determined in 2003/04.

Cost Sharing:

Each trial will be paid out of MYA funds for the particular parties involved and Ministry, Industry, and other funding sources.

Partnerships:

Potential partnerships with UNBC, CNC, MOF, MSRM, MWLAP, FERIC and Industry.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		170 000	680 000	590 000	320 000	240 000	2 000 000	5

Tactic 2	Monitoring, Analysis and Reporting of Operational Trials
Activity 1	Operational Trials Monitoring

Status of Knowledge:

There has been some research conducted on small scales in various locations in the region. There is a need to deliver the results of those trials to a larger audience. Few documented trials of alternative systems exist. Experience varies throughout districts.

Tactical Summary:

To be planned after initial harvesting of Pilot project

Status:

New

Tactical Objectives:

To develop a monitoring protocol to evaluate and accurately describe the effects of alternative harvesting techniques and how they impact sustainable forest management.

Tasks, Deliverables, Targets and Milestones (Tactical):

To develop Monitoring strategies that suit regional needs and project analysis

Trial sites revisited and surveys conducted to compare results

New information should be delivered to stakeholders through the knowledge catalogue

Cost Sharing:

Monitoring strategies could be funded through business partnerships with Government, Industry and research centres

Partnerships:

Potential partnerships with UNBC, CNC, MOF, MSRM, MWLAP, FERIC and Industry.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
				20 000	110 000	110 000	240 000	3

Activity 2	Analysis and Reporting of Operational Trial Results

Status of Knowledge:

There has been some research conducted on small scales in various locations in the region. There is a need to deliver the results of those trials to a larger audience. Few documented trials of alternative systems exist. Experience varies throughout districts.

Tactical Summary:

The review of the operational trials from a cost benefit perspective would be a key element to providing end users with successes and directions for future strategic planning.

Status:

New

Tactical Objectives:

To conduct an unbiased analysis of the operational trials and milestone objectives and to document and report on all operational results achieved.

Tasks, Deliverables, Targets and Milestones (Tactical):

Cost benefit analysis will be conducted in conjunction with the trials and would have similar targets and milestones. This analysis and reporting will need to continue after the trials to include silviculture activities.

Cost Sharing:

Each trial will be paid out of MYA funds for the particular parties involved and Ministry, Industry, and other funding sources.

Partnerships:

Potential partnerships with UNBC, CNC, MOF, MSRM, MWLAP, FERIC and Industry.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
			10 000	30 000	10 000	30 000	80 000	4

ISSUE 11: LACK OF ARCHAEOLOGICAL VALUE AND PRESERVATION OBJECTIVIES

Overview Description of the Regional Strategic Issue:

British Columbia's archaeological sites are protected under the *Heritage Conservation Act Heritage Conservation Act* (RSBC, Chap. 187, 1996). The Ministry of Forests is required by the *HCA* to ensure that impacts to archaeological sites by forest management activities are appropriately managed.

In the event that the locations of archaeological sites are not known, the *Forest Practices Code of British Columbia Act* provides for the protection of previously unidentified archaeological resource features which may be located during actual operations (Section 51). If encountered, a licensee must stop any activity that could damage a previously unidentified archaeological resource, and notify the district manager.

Plan proponents must apply for an alteration permit and identify methods that are approved by Archaeology Branch, Ministry of Sustainable Resource Management, to mitigate any possible disturbance to archaeological sites.

Current management tools and objectives for managing archaeological sites for the Region are inadequate.

The following definitions are pre-requisite to this analysis.

Cultural Heritage Resource:

The following definition of "cultural heritage resource" is taken from the *Heritage Conservation Amendment Act*:

"cultural heritage resource" means an object, a site or the location of a traditional societal practice that is of historical, cultural or archaeological significance to the Province, a community or an aboriginal people."

Cultural heritage resources include archaeology sites and traditional use sites.

Heritage Resources:

Heritage resources, as defined by the *BC Terminology Culture and Heritage Guide* 1997, include the following:

Archaeological Sites
Traditional Use Sites
Culturally Modified Trees
Trails & Routes
Graves and Burial Sites
Structural Features
Cultural Landscapes

Archaeological Site:

An archaeological site is any locality that exhibits physical evidence of the past activities of a person or group of people for which the application of scientific methods of inquiry (i.e. survey, excavation, data analysis etc.) are the main source of inquiry information. The key distinctions, which set archaeological sites apart from other heritage sites, are the presence of physical cultural remains, and the application of archaeological techniques of inquiry. Prehistoric and historic sites are two types of archaeological sites. Archaeological sites are protected by the *Heritage Conservation Act* (RSBC, Chap. 187, 1996).

Historic Site:

A historic site is any site or object dating to the period following the arrival of non-aboriginal people to the Province. Examples may include fur trade forts, homesteads, institutional or industrial buildings, missions, trails or roads. Historic sites often have documentary information regarding their use and occupancy, however, information pertinent to the understanding of many of these resources can be enhanced through the application of archaeological techniques of inquiry.

Traditional Use Site:

Traditional Use Site means any geographically defined site (on land or water) that has been traditionally used by one or more groups of people for certain types of activities. These sites often lack the physical evidence of human-made artefacts or structures, and will maintain cultural significance to a living community of people. Traditional Use Sites are usually documented with the assistance of oral, historical and archival sources. Examples include: sacred sites, resource gathering sites such as berry grounds, and sites of legendary or past event of cultural significance.

Information about the existence and nature of Traditional Use Sites is usually obtained through interviews with community elders, as well as archival and other literature research. Examples may include:

locations associated with traditional beliefs of an aboriginal group about its origins, its cultural history, or world view;

a location where a community has traditionally carried out economic or artistic or other cultural pursuits important to maintaining its historical identity;

an urban neighbourhood that is the traditional home of a particular cultural group, and that reflects its beliefs and practices.

Under certain circumstances, information pertinent to understanding some of these resources can be enhanced through the application of archaeological techniques of inquiry.

NOTE: "traditional" in this context refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations, usually orally or through practice. The traditional cultural significance of a particular resource, then, is significance derived from the role the resource plays in a community's historically rooted beliefs, customs, and practices.

Culturally Modified Tree:

A Culturally Modified Tree (CMT) is a tree or remnant of a tree associated with old growth forests, which bear evidence of traditional aboriginal forest use. Examples of CMT's may include bark-stripped cedar, cedar trees with evidence of plank removal, etc. (Archaeology Branch, Ministry of Small Business, Tourism & Culture 1996).

A CMT has also been defined as a "tree that has been intentionally altered by Native people participating in the traditional utilisation of the forest" (Vancouver Region, Ministry of Forests, February 1997).

CMTs may be either an indication of an aboriginal right being practised in an area (activity pre-dates European contact), or an archaeology site. The *Heritage Conservation Act* (RSBC, Chap. 187, 1996) provides protection for CMTs under S. 13(2)(d) and (g) as physical evidence of human occupation or use. This legislation applies to archaeological sites (including CMTs) if the modification pre-dates 1846, whether they are located on Crown or private land. The legislation also provides for the cutting and removal of CMTs under permit. Post 1846 CMTs are not protected under the *Act* but may show evidence of traditional use.

Trails and Routes:

Trails and routes are defined as any traceable line between two locations repeatedly travelled by humans. These heritage resources usually contain physical evidence such as a noticeable furrow in the ground or associated blazed or cambium stripped trees (CMTs) or archaeological sites associated or in close proximity. Trails that predate 1846 receive automatic protection under the *HCA* although it is often difficult accurately identify the exact location of a trail or establish the date of age of a trail.

Graves and Burial Sites:

Locations where human remains are intentionally placed. The *HCA* applies to graves and burial sites.

Structural Features:

Any buildings or structures made by humans. These heritage resources are usually associated with activities or events that retain meaning to a living community of people. They are generally documented and interpreted with the assistance of archival and oral historical information. Many of these resources are less than 200 years old and are generally associated with non-Aboriginal communities.

Cultural Landscapes:

Cultural Landscape is defined as any discrete aggregation of human made features that reside in conjunction with each other. The arrangement of these features may contain the following attributes:

It is representative of a distinctive cultural process in the development or use of land

over time; and/or

It is an area perceived as an ensemble of culturally derived landscape features such as a townscape, landscape or waterscapes that exhibits some interface between humans

and the environment (i.e. Barkerville, Fort Steele).

A First Nation cultural landscape might be a natural element with no evidence of human made features or alterations. In some cases, a First Nation cultural landscape may be simply a natural location in which the First Nation maintains an association.

Current Archaeological Site Management Studies:

Archaeological Overview Assessment:

An Archaeological Overview Assessment (AOA) determines the archaeology resource potential of an area proposed for land altering activities. Like mineral resources, the locations of archaeological sites are often unknown due to their subsurface nature and the length of time since abandonment. The overview is designed to predict archaeological site locations and guide subsequent impact assessment and management studies. These assessments are broad in nature and rely primarily on archaeological inventory information on the distribution of known archaeological sites.

The AOA assists in helping resource managers determine where to conduct Archaeological Impact Assessments (AIA). Archaeological Overview Assessments are useful in identifying archaeological resources other than CMTs and provide information on where gaps in the existing inventory may exist. Resource managers can then determine where AIAs or Culturally Modified Tree inventory studies would be most effective.

Forest Development Plan Review:

An archaeological review of Forest Development Plans (FDP) is undertaken in the absence of an AOA to identify proposed operational areas requiring further archaeological investigation. Recommendations for the scope and methodology of subsequent CMT inventory studies and/or impact assessment studies are expected from these reviews. The final product provides a database that is linked with the FDP and a report detailing the background, methods and results of investigation.

The FDP review is a focused, development-oriented study that will provide a greater level of detail. Individual blocks are assessed for archaeological resource potential. An archaeological review of a FDP could indicate areas where there is a low potential for archaeological resources other than CMTs but high potential to contain CMTs. This would allow the district to identify particular cutblocks that will require AIAs and those that require CMT inventories/preliminary field reconnaissance surveys.

Preliminary Field Reconnaissance:

An AOA may require a Preliminary Field Reconnaissance (PFR) or "walkthrough" as it is sometimes called, which may involve a simple overflight of a study area or, if greater intensity is demanded, a field survey using systematic or judgmental sampling techniques. Reconnaissance survey should be undertaken in the event that historical, archaeological, ethnological, or other documentary sources necessary for assessing the archaeological resource potential of a study area are insufficient or unavailable. A PFR is also warranted in the case where many alternatives are under consideration for the location of forestry activities.

Archaeological Impact Assessment:

An Archaeological Impact Assessment (AIA) is required where potential impacts to archaeological resources are identified in the AOA or the FDP archaeology review. AIAs are designed to provide the fullest possible understanding of archaeological resources that would be affected by land altering activities.

Relationship to Sustainable Forest Management:

The sustainable use of non-timber resources

Archaeological and cultural heritage resources may be at risk, and unexpected work stoppages may occur.

Archaeological resources in the NE typically have little impact on long-term timber supply. However, the uncertainty regarding the location of archaeological resources and their site-specific nature provide uncertainty at a site level (road and cutblock). This can cause frequent delays for permitting and accessing timber resources and can cause unnecessary conflict between the forest industry and First Nations groups.

There will be no impact on a Timber Supply decision rather the issue is the ability to appropriately manage site level resources as noted above.

Relationship to Strategic Resource Plans and Decisions:

Strategic Decisions:

Both the Dawson Creek and Fort St. John Land and Resource Management Plans identify the conservation of heritage resources as important concerns.

Strategy 1: Regional Strategic Planning

Status of Existing Knowledge:

Organisation, synthesis and analysis:

Overall direction for the management of archaeological resources within a forestry environment is simply an extension of archaeological resource management direction for the province. General goals of archaeological resource management are provided in the *British Columbia Archaeological Resource Management Handbook* and *British Columbia Archaeological Impact Assessment Guidelines*.

Strategic direction defines when and how archaeological planning, impact assessment and management studies will take place. This direction provides the framework for all archaeological resource management within the MoF planning framework. The different types of archaeological studies are discussed in the introductory section.

The following table (3.11.1) shows strategic direction given for other planning components.

Table 3.11.1

Planning Level	Strategic Level Direction
Higher Level Planning: Land and Resource Management Plans (LRMP)	Identification of LRMPs as the appropriate mechanism for developing an Archaeological Overview Assessment including AOA Methodology
Higher Level Planning: Landscape Unit Planning	Archaeological Inventory Study Methodology
Forest Development Plan Review	Direction on how to conduct a Forest Development Plan Review Process
Stand Level Management	Methodological direction for conducting Archaeological Impact Assessments

Strategic Planning input in Archaeological Studies:

Archaeological Overview Assessments (AOA):

The strategic planning structure focuses on the AOA as the central planning tool for identifying conflicts between forestry operations and archaeological sites. Direction is provided for AOAs to be developed on a district by district basis as a component of a higher level plan (i.e. LRMP). The methodological standard for this work is also specified at the strategic level. The resulting AOA products are used during Forest Develop Plan reviews to identify forestry operations with the potential to conflict with archaeological resources.

Archaeological Inventory Studies (AIS):

Archaeological Inventory Studies are defined as the primary mechanism for gathering baseline information on the location of archaeological sites and verifying the accuracy of district-wide AOAs. Archaeological Inventory Studies should be completed as part of Landscape Unit Planning to provide definitive information on the location of protected sites within identified sensitive areas. This additional information on site locations is used in the Forest Development Plan review and subsequent revisions of the district wide AOA.

Archaeological Review of Forest Development Plans:

District review of a Forest Development Plan utilises the existing AOA (if available) to identify which forestry operations will likely impact protected archaeological resources. The District Manager then instructs licensees to conduct an archaeological impact assessment in these areas prior to land altering activity.

Archaeological Impact Assessments (AIA):

Methodological guidelines for conducting AIAs are specified at the strategic level within the *British Columbia Archaeological Impact Assessment Guidelines*. These studies are conducted as part of stand level management.

Inventory:

AOA and AIS studies have been eligible for FRBC funding since 1996. The following table (3.11.2) shows the AOAs (or functional equivalents) used by each forest district in the region:

Extension:

Many strategic level documents are available are available to district users through the MSRM Archaeology Branch (http://www.archaeology.gov.bc.ca) and MoF Aboriginal Affairs Branch (http://www.for.gov.bc.ca/aab/aab.htm) websites.

Digital products resulting from an AOA study are provided to MoF in IDGS format, however these datasets are often too large for use by district level systems. All products from AIS and AIA studies (site forms and reports) and AOA reports are submitted in hardcopy format only and are not easily accessible for use by district staff.

Research:

Research studies can be applied to three areas: the strategic planning framework, AOA methodology and AIS methodology. To date, no systematic examination of the integration of the archaeological resource management planning process with the MoF planning structure has been undertaken since the implementation of the *Ministry of Small Business, Tourism and Culture and Ministry of Forests Protocol Agreement on the Management of Cultural Heritage Resources, 1996.*

AOA methodology is continually changing as influenced by changes in GIS and modelling theory.

Archaeological inventory study methodology has been examined recently to aid in establishing the *British Columbia Archaeological Inventory Study Guidelines.*

Monitoring:

No systematic monitoring of the effectiveness of strategic direction within forest districts has been conducted.

Table 3.11.2

Forest District	Operational Level AOA	Other
Dawson Creek*	Existing (revision ongoing)	
Fort Nelson*	Existing (revision ongoing)	
Fort St. James		Formula to evaluate individual operations
Fort St. John*	Existing (revision ongoing)	
Mackenzie	Under development	
Prince George		Formula to evaluate individual operations
Robson Valley		None – Existing AOA suitable for strategic level planning only.
Vanderhoof	Existing	

Recommended Knowledge Solution:

The overall integration of an archaeological resource management structure within the forestry planning process has not been well articulated. A general introduction to forestry related archaeological resource planning, including source documentation, is required for planners to understand and improve archaeological resource management within each district. In addition to being able to source these documents, planners within MoF and industry should participate in training/workshops to gain familiarity with the processes and activities;

Archaeological Overview Assessments have been completed for over half of the districts in the region. The studies should be revised to incorporate additional information and more accurate data sets that have been developed since the studies were first completed. The original terms of reference for developing these studies are not applicable to their revision. Terms of reference for the revision of these studies should be developed;

Management direction within the AOAs has not been standardised. These studies generally divide the landscape into zones of high, moderate high, moderate and low potential. However the definitions of what constitutes high, moderate etc. varies with each study. Thus management direction in adjacent districts may differ for areas of similar archaeological potential. Potential zones should be defined in terms of archaeological site density per km. or other objective measure across the province;

Archaeological Inventory Studies should be identified as the level of study required to bridge the gap between high level (i.e. district wide) generalised AOAs and the particulars of operation level planning. Archaeological Inventory Studies should be used at the Landscape Unit Planning Level to test the validity of the AOA within a single landscape unit and to gather additional information of individual site locations in archaeologically sensitive areas;

An alternative to AIS studies at the landscape unit is the formalised input of professional archaeologists in determining licensee AIA requirements. Professional expertise and accountability are thereby employed to bridge the gap between generalised AOAs and operational planning; and

Specific, strategic-level direction is required by the districts concerning resource management of post 1846 culturally modified tree sites and beetle kill areas.

Resource Inventory:

The efficiency and effectiveness of AIS can be improved through the creation of guidelines to identify the location and methodological parameters of inventory studies used in landscape unit planning.

Extension:

Products resulting from archaeological resource management studies would be better utilised if:

All information is collected and submitted in a standard digital format;

A coverage of the location of all archaeological studies within the region was maintained (to support decisions made under General Bulletin 11 of the *Forest Practices Code*); and

All archaeological information in the region is readily available through the Archaeological Inventory Data Centre (AIDC) maintained by the Archaeology Branch, MSRM.

Research:

Additional research is required in the following areas to support the above initiatives:

Systematic sampling of Culturally Modified Tree Sites.

Culturally Modified Tree sites can be very large. Sampling techniques can be used to record these sites efficiently while ensuring that important site and feature attributes are adequately noted; and

Sampling Design and Beetle Kill Salvage Operations.

Standard approaches to managing forestry related impacts to archaeological sites cannot be used effectively with Beetle Kill salvage due to the drastically shortened planning period. Alternative techniques such as post harvest assessments and sampling of a limited number of randomly selected sites to support model building should be explored.

Monitoring:

FRBC has contracted services to produce quality assurance certification for AOAs and AISs however, no systematic regional monitoring of archaeological resource management activities has been conducted in the Prince George Forest Region. Subjective evaluations of the effectiveness of AOAs have been made but little progress can be made until the objective study of the usefulness of these studies can be made and recommendations forwarded for their improvement.

Strategic Performance Indicators, Targets & Milestones:

Specific information is provided in Tactical descriptions.

Relationship to other SSFM Knowledge Strategies:

Tactic 1	Archaeological Resource Management Extension

Status of Knowledge:

See Strategy description.

Tactical Summary:

There are no documents discussing the framework and activities of forestry related archaeological resource management. The Protocol Agreement on Cultural Resource Management between the Ministry of Forests and the Ministry of Small Business, Tourism and Culture (1994) discussed the archaeological resource management activities required during at different forest planning stages, but this document was amended in 1996. The new agreement does not contain this general structure.

A general introduction to forestry related archaeological resource planning, including source documentation, is required for planners to understand and improve archaeological resource management within each district. In addition to being able to source these documents, planners within MoF and industry should participate in training/workshops to gain familiarity with the processes and activities.

The presentation of the planning framework should include the identification of Archaeological Inventory Studies as the mechanism for adapting the generalised AOA study to a specific landscape unit

Status:

New

Tactical Objectives:

Develop an overview document on archaeological resource management to ensure district planners can utilise planning tools to their fullest extent.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development of a draft document;

Review by regional staff and Archaeology Branch, MSRM;

Post final overview document and all source materials (referenced protocols, guidelines, standards and excerpts from code and regulations) to dedicated web page;

Development of supporting workshop course material; and

Delivery of workshops for industry and district staff.

Cost Sharing:

Costs included only if Archaeology Branch, MSRM is unable to complete this activity.

Partnerships: Document Review by Archaeology Branch, MSRM.								
Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		25 000					25 000	1

Tactic 2	Regional Archaeological Overview Assessments
Project 1	Regional Archaeological Overview Assessments Revision

Status of Knowledge:

See Strategy description.

Tactical Summary:

Sufficient new information concerning archaeological site locations has been collected since many of the district AOAs were completed. Revisions of these AOAs will increase their accuracy by including the new site location information with the latest environmental data sets. However, the contracting standards developed for Archaeological Overview Assessments (AOA) are not appropriate for AOA revisions. Therefore, revisions standards should be developed to provide direction for updating AOAs.

Status:

New

Tactical Objectives:

Develop revision standards for AOAs to ensure that updated products effectively address archaeological resource management requirements.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development of a draft revision standards; and

Review by regional staff and Archaeology Branch, MSRM.

Cost Sharing:

Costs included only if Archaeology Branch, MSRM is unable to complete this activity.

Partnerships:

Document Review by Archaeology Branch, MSRM.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		2 500					2 500	1

Project 2	Archaeological Overview Assessment Contracting Standards Revision

Status of Knowledge:

See Strategy description.

Tactical Summary:

Current Archaeological Overview Assessment contracting standards do not define thresholds for archaeological potential rankings (i.e. High, Moderate High, Moderate, Low, Unknown). Districts have requested standardisation of this resource management direction so that licensees receive the same direction for similar environmental conditions in different districts.

Status:

Existing

Tactical Objectives:

Standardise resource management direction within AOA studies across districts

Tasks, Deliverables, Targets and Milestones (Tactical):

Development of a draft revision standards; and

Review by regional staff and Archaeology Branch, MSRM.

Cost Sharing:

Partnerships:

Developed with Aboriginal Affairs Branch, MoF and Archaeology Branch. Document Review by Archaeology Branch, MSRM.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		N/A					N/A	1

Project 3	District-Wide Archaeological Overview Assessments Monitoring

Status of Knowledge:

See Strategy description.

Tactical Summary:

Archaeological Overview Assessments are the main tool for identifying potential conflicts between forestry operations and protected archaeological resources. Where potential conflicts are identified, Archaeological Impact Assessments (AIAs) are required. The purpose of the AIA's is to locate archaeological sites and assess their significance and nature of impact within the operational area in order to formulate archaeological management recommendations. However, forest districts do not systematically track AIA results. This makes it difficult to assess how well the AOA predicts the presence of archaeological sites.

Therefore, the effectiveness of the AOA should be monitored through the systematic tracking of results from the required AIAs. An AIA tracking system has been developed and piloted in the Campbell River Forest District. Although the system works well, the cost of implementation and upkeep are too high for province wide implementation. Implementation costs for each region have not been examined and should be investigated for the Prince George Forest Region.

Status:

Existing

Tactical Objectives:

Objectively measure the effectiveness and efficiency of AOAs.

Tasks, Deliverables, Targets and Milestones (Tactical):

Examine costs of implementing AIA Tracking System.

Cost Sharing:

Partnerships:

Document Review by Archaeology Branch, MSRM.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		5 000					5 000	1

Tactic 3	Archaeological Management of Post 1846 Culturally Modified Trees
Project 1	Regional Policy on Management of Post-1846 CMT Sites

Status of Knowledge:

See Strategy description.

Tactical Summary:

Sites consisting of post 1846 culturally modified trees (CMT) are not protected by the Heritage Conservation Act. However, decisions regarding the disposition of these sites are a Delgamuukw responsibility, therefore, management of these sites are involve consultation with First Nations.

The recording and management of post 1846 CMTs is uneven across the districts. Regional direction is required to determine how these sites should be recorded and managed.

Status:

New

Tactical Objectives:

Development of a regional post 1846 CMT position to ensure consistent data gathering and site management direction.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development of a draft regional position. Existing direction is found in Vanderhoof and Prince George district and the Cariboo Forest Region; and

District and regional review of draft document.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		N/A					N/A	1

Project 2	Sampling Protocol for Survey ofPost-1846 CMT Sites

Status of Knowledge:

See Strategy description.

Tactical Summary:

Culturally Modified Tree sites can be very large. Sampling techniques can be used to record these sites efficiently while ensuring that important site and feature attributes are adequately noted;

Status:

New

Tactical Objectives:

Development of a regional sampling protocol for use in the survey of culturally modified trees.

Tasks, Deliverables, Targets and Milestones (Tactical):

Undertake design and testing of an efficient, statistically valid sampling protocol for identification of post-1846 culturally modified trees.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		30 000					30 000	1

Tactic 4	Archaeological Values Management in Bark Beetle Infestation Zones
Project 1	Regional Policy on AIA's in Mountain Pine Beetle Salvage Areas

Status of Knowledge:

See Strategy description.

Tactical Summary:

It is not always possible to complete an archaeological impact assessment on a beetle kill locality with archaeological potential prior to tree removal. Tree removal can result in destruction of protected archaeological sites resulting in serious legal liability for the operator.

Legal obligations under the Heritage Conservation Act must be balanced against issues of forest health and a resulting strategy developed for the region.

Status:

New

Tactical Objectives:

Development of a regional position on archaeological resource management obligations versus forest health.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development of a draft regional position based on legal opinion; and

District and regional review of draft document.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		N/A					N/A	1

Project 2	AIA Sampling Protocol for Proposed Mountain Pine Beetle Salvage Areas

Status of Knowledge:

See Strategy description.

Tactical Summary:

Standard approaches to managing forestry related impacts to archaeological sites cannot be used effectively with Beetle Kill salvage due to the drastically shortened planning period. Alternative techniques such as post harvest assessments and sampling of a limited number of randomly selected sites to support model building should be explored.

Status:

New

Tactical Objectives:

Development of a rapid and efficient regional sampling protocol for use in proposed salvage operations.

Tasks, Deliverables, Targets and Milestones (Tactical):

Undertake design and testing of a suitable, statistically valid sampling protocol for use in Archaeological Impact Assessments on Beetle salvage areas.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		30 000					30 000	1

Tactic 5 | **Archaeological Inventory Data Management**

Status of Knowledge:

See Strategy description.

Tactical Summary:

Effective and efficient archaeological resource planning depends on access to all available planning studies. In the past, spatial information had to be requested from the Archaeology Branch and archaeological resource management studies ordered in hardcopy from the Heritage Resource Centre.

An Archaeological Inventory Data Centre has been created as a self service web site to access all relevant spatial data sets and resource management reports. However, there is insufficient funding to include two important data sets; archaeological impact assessment reports in the "virtual library" and a spatial coverage showing where archaeological resource management studies have taken place. Access to these data sets is vital for informed, effective management decisions.

This data source would be extremely useful if all archaeological reports for the last five years were available online. Standardised electronic submission of all new reports and spatial coverage's would also support this data source. Development of these standards should be a contract deliverable.

Status:

New

Tactical Objectives:

To increase accessibility of key data to enable informed resource management decision making.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development of 2 Contract Terms of Reference for:

Adding regional reports to the online library of the Archaeological Inventory Data Centre; and

Developing spatial coverage of regional archaeological studies and standards for submitting information to the AIDC.

Awarding Contract; and

Acceptance of deliverables.

Cost Sharing:

Cost sharing with Oil and Gas Commission should be explored.

Partnerships:

All other interested line Ministries (MEM, MoH etc.) Previous investment and development of web site conducted by Aboriginal Affairs Branch, MoF. Archaeology Branch, MSRM is now the owner of the web site. Work must be in co-operation with this group.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		50 000					50 000	1

Strategy 2: Higher Level Planning

Status of Existing Knowledge:

Organisation, synthesis and analysis:

Land and resource management studies are the broadest higher level plan in the provincial planning process. Strategic direction for archaeological resource management within an LRMP addresses two areas:

Development of an AOA as the basic planning tool for the study area (usually corresponding to a forest district); and

Identification of special management zones to be managed for archaeological resources.

Two related activities at the LRMP level are:

A description of the resource, related legislation and general management direction within the plan; and

Identification of unprotected heritage sites of provincial or regional significance as candidates for Provincial designation.

Inventory:

LRMPs have been completed for all areas within the Prince George Forest Region. The following table (11.3) displays completed archaeological resource management direction given in each plan:

Table 11.3

LRMP	General Management Direction	Strategic AOA	Operational AOA	Special Management Zones for Archaeological Values	Candidates for Provincial Designation
Dawson Creek	✓	✓	✓		
Fort St. James	✓				
Fort St. John	✓	✓	✓		
Fort Nelson	✓	✓	✓		
Mackenzie	✓				
Prince George	✓	✓			
Robson Valley	✓	✓			
Vanderhoof	✓	✓	✓		

Extension:

Land and Resource management plans showing archaeological resource management direction and specific goals and strategies are available through the internet at http://www.luco.gov.bc.ca/lrmp. The Archaeological Overview Assessments and spatial products (potential mapping) completed during the LRMP processes are found in the Archaeological Inventory Data Centre at http://www.archaeology.gov.bc.ca.

Research:

Archaeological Overview Assessments utilising predictive modelling have a strong research component to determine optimum modelling variables and techniques.

Monitoring

Committees monitor each LRMP. However, the effectiveness of archaeological resource management goals and strategies outlined in each plan are not specifically addressed. No archaeological expertise is currently available to assist the monitoring committees.

Recommended Knowledge Solution:

Organisation, synthesis and analysis:

The major trend when reviewing the implementation of strategic higher level planning tools is the lack of archaeological expertise needed to successfully apply this knowledge to reviews of forestry operations. AOA implementation at the district level must include seminars and workshops to all individuals who utilise the products of an AOA (primarily the potential maps). Workshop seminars should include basic information regarding the use, strengths and weakness of the district AOAs and mechanisms to monitor and upgrade the archaeological models of land use, as new information becomes available.

Resource Inventory:

No operational level AOAs have been developed for the Fort St. James, Prince George and the Robson Valley.

Extension:

All plans, studies and spatial data are currently available. However, Archaeological Overview Assessment study reports should be submitted in electronic format for access by users who do not have access to hardcopy documents.

Research:

No research projects have been identified for this planning level.

Monitoring:

Monitoring of an overview's effectiveness should be a landscape unit plan activity.

Strategic Performance Indicators, Targets & Milestones:

Specific information is provided in Tactical descriptions.

Relationship to other SSFM Knowledge Strategies:

Tactic 1	Archaeological Overview Assessments
Project 1	Archaeological Overview Assessment Review: Dawson Creek, Fort Nelson and Fort St. John Forest Districts

Status of Knowledge:

See Strategy description.

Tactical Summary:

The current AOAs for the Dawson Creek, Fort Nelson and Fort St. John Forest Districts were found inadequate for operational planning by the Oil & Gas Commission, Ministry of Energy & Mines (MEM). This commission has funded a five-year project to upgrade and revise the existing AOAs. The project is now in its second year and is directed by a steering committee representing the MEM, Ministry of Sustainable Resource Development and the Ministry of Forests. Forestry participation on the steering committee should be improved to best represent the interests of MoF and the forest industry.

Status:

Existing

Tactical Objectives:

To ensure the revised AOA within the northeastern forest district meets the needs of MoF and the forest industry through informed participation on the AOA project steering committee.

Tasks, Deliverables, Targets and Milestones (Tactical):

Striking of forestry subcommittee representing the Dawson Creek, Fort Nelson and Fort St. John Forest Districts and major licensees.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		10 000	10 000	10 000	10 000	10 000	50 000	5

Project 2	Archaeological Overview Assessment Review: Mackenzie Forest District

Status of Knowledge:

See Strategy description.

Tactical Summary:

Licensees within the Mackenzie Forest District have overseen the development of a district wide AOA. Contacting issues are preventing the completion of this work. The licensees should be supported in resolving these problems so that this central planning tool can be distributed to licensees and district staff.

Should contracting issues not be resolvable, the study should be reviewed to determine what steps are necessary to complete this work by a third party.

Status:

Existing

Tactical Objectives:

To complete the district wide AOA for the Mackenzie Forest District. This study serves as the basis for subsequent archaeological resource management studies.

Tasks, Deliverables, Targets and Milestones (Tactical):

Legal review to resolve contracting issues; and

If necessary, third party review of project deliverables to date to determine methods and cost to complete the AOA study.

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		20 000					20 000	1

Project 3	Archaeological Overview Assessment Review: Robson Valley Forest District

Status of Knowledge:

See Strategy description.

Tactical Summary:

No operational scale Archaeological Overview Assessment has been developed for the Robson Valley Forest District. A comprehensive data gap analysis should be completed to determine if predictive modelling within an AOA is an appropriate method of developing archaeological potential mapping. Should basic archaeological and environmental information required for modelling be underdeveloped within the district, alternative methods of estimating archaeological potential must be investigated. Alternative methods could include:

The use of generalised archaeological potential formulae;

Modelling for specific operational areas; and

Deferring archaeological potential estimates to the landscape unit component of higher level planning.

Status:

New

Tactical Objectives:

To develop archaeological resource management tool options that aid in identifying conflicts between forestry operations and protected archaeological sites during forest development plan reviews.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development of data gap analysis terms of reference;

Contracting data gap analysis;

Acceptance of final report; and

Development and circulation of expression of interests for preferred option(s).

Cost Sharing:

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		10 000					10 000	1

Strategy 3: Landscape Level Planning

Status of Existing Knowledge:

Organisation, synthesis and analysis:

Archaeological Inventory Studies are the key planning tool available at the landscape unit planning stage. The purpose of implementing AIS at this level are threefold:

Confirm the accuracy of archaeological site location predictions made within the AOA;

Inventory archaeological site locations in areas of special interest or sensitivities; and

Inventory other heritage features, such as trails.

Another benefit of landscape level inventory is the additional information available for revisions of the AOA.

Inventory:

No watershed level inventories have been conducted within the Prince George Forest Region.

Extension:

The current *British Columbia Archaeological Inventory Guidelines* require paper site forms and hardcopies of a final report to be submitted to the Archaeology Branch.

Research:

No research has been conducted to aid planners in determining where Archaeological Inventory Studies should take place within watersheds.

Monitoring

N/A

Recommended Knowledge Solution:

Improve the effectiveness of Archaeological Inventory Studies (AIS) by:

Developing guidelines on where these studies would be used in landscape planning; and

Revising the *British Columbia Archaeological Inventory Study Guidelines* to provide for the electronic submissions of information to support GIS studies and the Archaeological Inventory Data Centre.

This strategy would include the effective use of the existing planning infrastructure and additional guidelines to aid in landscape level planning.

Organisation, synthesis and analysis:

Guidelines must be developed to aid planners in identifying what type of AI studies are required, where AI studies should take place and how the results can used to modify AOAs at the local level. The resulting Archaeological Impact Assessments (AIAs) will be better placed with this local knowledge.

Extension:

The existing *British Columbia Archaeological Inventory Study Guidelines* should be revised to require that all deliverables be submitted as digital text and spatial files.

Research:

No research projects have been identified for this planning level.

Strategic Performance Indicators, Targets & Milestones:

Specific information is provided in Tactical descriptions.

Tactic 1	Archaeological Inventory Studies in Landscape Unit Planning
Project1	Regional Archaeological Studies Guidelines and Extension

Status of Knowledge:

See Strategy description.

Tactical Summary:

Archaeological studies are seldom identified for landscape unit planning, but this is the opportunity to modify district wide higher level planning tools to the specifics of a particular locale or landscape unit. Archaeological Inventory Studies are the mechanism for verifying the accuracy of the district wide AOA for specific areas, but guidelines do not exist to aid district planners in identifying the scope and focus of these studies.

Status:

New

Tactical Objectives:

To increase the effectiveness of Landscape Unit Planning and Forest Development Review through the use of AISs. These studies aid in adapting district wide AOAs to local conditions/situations.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development of AIS guide outlines;

Completion of AIS draft guidelines;

Workshop with selected district and application to major planning process; and

Revisions and acceptance of final AIS guidelines.

Cost Sharing:

Costs included with Strategy 1, Tactic 1 - Archaeological Management. One Landscape Unit should be selected for pilot.

Partnerships:

Technical support from Archaeology Branch, MSRM. Licensees, UNBC Department of Anthropology.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		10 000					10 000	1

Project 2	Revision of the British Columbia Archeological Inventory Study Guidelines

Status of Knowledge:

See Strategy description.

Tactical Summary:

Effective planning requires access to all reports and spatial data generated by archaeological resource management studies for the region. The central repository for this information should be the Archaeological Inventory Data Centre maintained by the Archaeology Branch, MSRM. The current guidelines for AIS (*British Columbia Archaeological Inventory Study Guidelines*) do include requirements for study deliverable to be submitted in a digital format compatible with the data centre. Guidelines should be revised to include these requirements.

Status:

Existing

Tactical Objectives:

To increase the effectiveness of regional archaeological resource management through access to a central repository containing all archaeological spatial data and resource management reports.

Tasks, Deliverables, Targets and Milestones (Tactical):

Legal review to resolve contracting issues; and

If necessary, third party review of project deliverables to date to determine methods and cost to complete the AOA study.

Cost Sharing:

Partnerships:

Archaeology Branch, MSRM is the custodian of these standards. Revisions must be done in partnership with this branch.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		2 500					2 500	1

Strategy 4: Forest Development Planning

Status of Existing Knowledge:

There is insufficient archaeological expertise within MoF to successfully review the archaeological component of forest development plans. A level of familiarity can be gained through workshops for district staff. However, a pilot study is recommended utilising archaeological expertise in plan reviews. The pilot would examine the potential for markedly greater efficiencies and improved archaeological resource management by contracting the services of a cultural resource management archaeologist at the regional level. Services would include continued development of higher level planning tools and their application at the FDP review stage.

Planning tools and archaeological study results should be readily available for all planners. The Archaeological Inventory Data Centre should be enhanced to contain all pertinent data for the Prince George Forest Region. Archaeological reports and spatial data would be available online for easy of access and updating.

The efficiencies and effectiveness of the FDP review should be monitored.

Organisation, synthesis and analysis:

These operational level forest plans are developed by the forest licensees and reviewed by forest district staff. High level archaeological planning tools (AOAs and applicable AISs) as well as general heritage inventories (e.g. Traditional Use Studies) are used to determine where proposed forestry operations will conflict with known or suspected archaeological site locations. Where sufficient potential for conflict exists, the District Manager will require that archaeological impact assessments (AIAs) and necessary archaeological impact management (AIM) studies are completed as a condition of operation.

Inventory:

The following table (3.11.4) notes the planning tools used in each district to complete forest development reviews:

Table 3.11.4

Forest District	Known Arc Sites	AOAs	AIS Results	PFR	Site Specific AISs	Other AIA Results	TUS	First Nation Consult
Dawson Creek	No response to questionnaire							
Fort St. James	✓	Predictive Formulae		✓			✓	✓
Fort St. John	✓	✓		✓			✓	✓
Fort Nelson								
Mackenzie	✓	✓		✓			✓	✓
Prince George	✓	Predictive Formulae		✓	✓	✓	✓	✓
Robson Valley							✓	✓
Vanderhoof	✓	✓		✓	✓	✓	✓	✓

Extension:

Current archaeological site location and AOA information must be requested from the Archaeology Branch. Archaeology Branch has only recently collected AOA information. Each site information update requires a new data request.

There is no obligation for the licensees to forward AIA interim or final reports to MoF. Therefore it is difficult for MoF to build an information databank based on AIA results to aid in resource management decision making.

Research:

No research or pilot studies have focused on the FDP review process.

Monitoring

No systematic monitoring of the effectiveness of the FDP review has been conducted.

Recommended Knowledge Solution:

Improve the effectiveness and efficiency of the archaeological component of a forest development plan review through:

Training of district staff in the application of higher level plan archaeological studies as they apply to operational level planning;

Including archaeological expertise in the review of development plans where insufficient guidance exists for district staff to make informed recommendations on the need and nature of stand level management studies; and

Enhancing regional data in the Archaeological Inventory Data Centre to aid in archaeological resource management decision making.

This strategy would entail the more effective use of the existing information.

Organisation, Synthesis and Analysis:

These operational level forest plans are developed by the forest licensees and reviewed by forest district staff. High level archaeological planning tools (AOAs and applicable AISs) as well as general heritage inventories (e.g. Traditional Use Studies) are used to determine where proposed forestry operations will conflict with known or suspected archaeological site locations. Where sufficient potential for conflict exists, the District Manager will require that archaeological impact assessments (AIAs) and necessary archaeological impact management (AIM) studies are completed as a condition of operation.

Inventory:

The following table (3.11.5) notes the planning tools used in each district to complete forest development reviews:

Table 3.11.5

Forest District	Known Arc Sites	AOAs	AIS Results	PFR	Site Specific AISs	Other AIA Results	TUS	First Nation Consult.
Dawson Creek								
Fort St. James	✔	Predictive Formulae		✔			✔	✔
Fort St. John	✔	✔		✔			✔	✔
Fort Nelson								
Mackenzie	✔	✔		✔			✔	✔
Prince George	✔	Predictive Formulae		✔	✔	✔	✔	✔
Robson Valley							✔	✔
Vanderhoof	✔	✔		✔	✔	✔	✔	✔

Extension:

Current archaeological site location and AOA information must be requested from the Archaeology Branch. Archaeology Branch has only recently collected AOA information. Each site information update requires a new data request.

There is no obligation for the licensees to forward AIA interim or final reports to MoF. Therefore it is difficult for MoF to build an information databank based on AIA results to aid in resource management decision making.

Research:

No research or pilot studies have focused on the FDP review process.

Monitoring:

No systematic monitoring of the effectiveness of the FDP review has been conducted.

Strategic Performance Indicators, Targets & Milestones:

Specific information is provided in Tactical descriptions.

Tactic 1	Archaeological Resource Management Training - Field Staff

Status of Knowledge:

See Strategy description.

Tactical Summary:

The application of high level planning tools to local areas such as in the forest development plan review is complicated. To date, the implementation of these higher level tools has been poor. District and/or licensee staff need the opportunity to gain familiarity with these products, how they can be applied, modified and assessed for strengths and weakness through a short training course.

Status:

New

Tactical Objectives:

To increase the effectiveness of archaeological resource management through district staff training on application of higher plan training to forest development plan review.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development of a course outline; and

Training for district staff as new planning tools come online.

Cost Sharing:

Partnerships:

Technical support from Archaeology Branch, MSRM.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		20 000					20 000	1

Tactic 2	Forest Development Plan Archaeological Review Process – Pilot

Status of Knowledge:

See Strategy description.

Tactical Summary:

Many of the issues in archaeological resource management planning can be directly addressed by including archaeological expertise in the planning processes. To bolster any argument for a permanent position, it is necessary to run a pilot to demonstrate advantage gained by having an archaeologist on staff at the regional level to assist in higher level and forest development planning.

Status:

New

Tactical Objectives:

To objectively measure the increased efficiencies and effectiveness of a staff archaeologist on archaeological resource management.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development of a job description for archaeologist;

Development of measurable outputs to examine the efficiencies and effectiveness of the new position;

Hiring for duration of pilot project; and

Report on effectiveness of position.

Cost Sharing:

Prince George Forest Region to provide administrative and technical support.

Partnerships:

Technical support from Archaeology Branch, MSRM. Infrastructure Aboriginal Affairs Branch, MoF.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000					100 000	1

Strategy 5: Stand Level Management

Status of Existing Knowledge:

Organisation, synthesis and analysis:

Archaeological impact studies are required by the District Manager as a condition of permit for identified operations. These operations have the potential to conflict with protected archaeological resources and have been identified during the Forest Development Plan review.

Three types of archaeological studies are common stand level management techniques; Archaeological Impact Assessments (AIAs), Archaeological Impact Management Studies (AIM) and Preliminary Field Reconnaissance (PFR). These studies are defined in Issues description.

Inventory:

All field assessment studies result in hardcopy reports that are submitted to the client. In the case of permitted studies (AIA & AIM) reports are also filed with the Archaeology Branch. However, there is no obligation to submit these reports to MoF.

Extension:

Preliminary Field Reconnaissance reports are kept by clients. AIA and AIM reports are available in hardcopy from the Heritage Resource Data Centre, MSRM

Research:

Efficient, accurate recording of CMT sites was investigated in the paper *Sampling Culturally Modified Tree Sites* (Muir & Moon, 2000 on file with the Aboriginal Affairs Branch, MoF).

Monitoring:

Monitoring of permitted archaeological resource management studies is the responsibility of the Archaeology Branch, MSRM. Review of submitted work is completed on a permit by permit basis. There has been no monitoring of the field component of this work, although it is within the purview of the branch heritage resource specialist to do so.

Recommended Knowledge Solution:

Improve the effectiveness and efficiency of the stand level management through :

Training of field staff in archaeological site awareness and resource management;

Improving culturally modified tree recording methodology;

Systematic recording of preliminary field reconnaissance (PFRs); and

Storage of results in the Archaeological Inventory Data Centre.

This strategy would entail the more effective use of the existing information

Organisation, Synthesis and Analysis:

Preliminary Field Reconnaissance work should be completed to a common standard and submitted to a central repository (the Archaeological Inventory Data Centre). Field staff should be trained in the basics of site recognition and resource management so that resources can be identified in the field.

Research:

The CMT sampling methodology must be field-tested before it can be accepted as a regional or provincial standard for recording these sites.

Strategic Performance Indicators, Targets & Milestones:

Specific information is provided in Tactical descriptions.

Tactic 1	Archaeological Resources and Values Extension – Field Staff

Status of Knowledge:

See Strategy description.

Tactical Summary:

Familiarise operators with archaeological resource management and local archaeological site types as applied to forestry operations. Workshops should be held annually in each Forest District.

Status:

Existing

Tactical Objectives:

The preservation of protected archaeological resources can depend on the knowledge of the staff operating in the field. Section 51 of the *Forest Practices Code* provides a mechanism for heritage conservation but success depends on the ability of field staff to recognise archaeological sites and know what steps must be taken. If staff are properly trained all field operations, from timber cruising to road building, provide an opportunity to identify archaeological material.

Tasks, Deliverables, Targets and Milestones (Tactical):

One or two day workshops, including a classroom presentation and field component, should be held in each district annually.

Cost Sharing:

Participating licensees.

Partnerships:

First Nations, licensees.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
5 000+	1	10 000	10 000	10 000	5 000	5 000	40 000	5+

Tactic 2	Culturally Modified Tree Recording Methodology

Status of Knowledge:

See Strategy description.

Tactical Summary:

Culturally Modified Tree (CMT) sites can be very large. Sites consisting of thousands of cambium stripped trees have been recorded in the central area of the province. These sites can be extremely time-consuming to record. Considerably efficiencies can be gained if these sites are sampled and summarised statistically instead of recording each modified tree individually. The methodologies have been developed for statistical recording but have not been field-tested. Consideration must be given to field-testing so that these methodologies may be adopted as a regional standard.

Status:

Existing- methodological strategy completed last year by Aboriginal Affairs Branch, MoF in partnership with the Archaeology Branch. No opportunity to field-test.

Tactical Objectives:

Statistical sampling of CMT sites will save considerable time and effort in recording these sites without sacrificing knowledge gained. Methodologies may be adopted as regional standards upon completion of the field-testing component.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development and completions of a field-testing program to validate CMT site recording sampling methodologies.

Development of testing program;

Completion of field testing;

Acceptance of final report; and

Adoption as regional standard.

Cost Sharing:

Licensee(s) in selected pilot area.

Partnerships:

First Nations, licensee(s), UNBC Department of Anthropology.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
20 000	1	60 000					60 000	1

Tactic 3	Preliminary Field Reconnaissance Data Management

Status of Knowledge:

See Strategy description.

Tactical Summary:

Considerable effort is expended in conducting Preliminary Field Reconnaissance work to determine if a particular locale or proposed forestry operation will impact protected archaeological resources. Much of this work is ad hoc with the results reported to the client in a variety of formats. If this work is standardised, results can be used in higher level planning. To be successful, these reports would have to be easily accessible by planners and archaeological consultants in industry and government.

Status:

New

Tactical Objectives:

Access knowledge gained through PFRs in higher level planning.

Tasks, Deliverables, Targets and Milestones (Tactical):

Development of standard PFR reporting form; and

Specify mechanism for submitting forms to the Archaeological Inventory Data Centre as a central repository.

Cost Sharing:

Partnerships:

Technical support from Archaeology Branch, MSRM.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		5 000					5 000	1

ISSUE 12: INCOMPLETE OR OUTDATED VISUAL LANDSCAPE INVENTORIES

Overview Description of the Regional Strategic Issue:

Visual landscape inventories (VLI) delineate, classify, and record the areas that are considered visually sensitive and that could give rise to public concern if their appearance were altered by resource development activities. VLIs also serve to locate and delineate areas that might serve as candidates for identification as scenic areas under the Forest Practices Code, and for which forest district managers or higher level plans may wish to establish Visual Quality Objectives.

VLIs are carried out at two scales:

> Broad scale assessment (1:250,000 scale), which classifies the land base into Visually Sensitive Areas versus Not Visually Sensitive Areas versus Unclassified Areas; and,
>
> Detailed field assessment (1:50,000 scale), which further classifies the Visually Sensitive Areas into Visual Sensitivity Units and describes these units in terms of their existing visual conditions, visual absorption capabilities, and biophysical characteristics, and classifies them into Visual Sensitivity Classes.

Knowledge gaps currently exist in each Forest District due to the many visually sensitive/scenic areas identified by the LRMP and other planning processes not mapped at any scale and to the many existing VLIs (broad and detailed) being outdated.

Over the past few years, the broad and detailed VLI data have been merged for each forest district, integrated into the corporate (provincial) database and made available on a limited basis through the Recreation Resources Inventory pilot web site. This has been, however, a one-time exercise and this initial integration was based on outdated data for many areas and since then, any new VLI data that have been captured have not been uploaded due to a lack of resources.

Improving the reliability, completeness, and accessibility of visual landscape inventory information in each district will provide better tools in making strategic decisions and managing visual values over time and space in a sustainable manner.

Relationship to Sustainable Forest Management:

The preamble of the FPC of BC Act emphasises that "British Columbians desire sustainable use of the forests, which includes conserving scenic diversity". Without an adequate knowledge base, there are inherent risks of mismanaging the visual resource by inadequate integration into strategic plans and by creating adverse visual impacts on visually sensitive landscapes. This, in turn, creates uncertainty regarding the maintenance of environmental values and the sustainable use of timber and non-timber resources.

The Maintenance of Environmental Values:

The visual resource is one of the legislated forest resources to be managed and conserved in this province and is an integral part of the environmental values considered important by society. More accurate knowledge on the location of the visually sensitive landscapes, what makes them important, and how sensitive they are to alteration are but a few of the knowledge information gathered through visual landscape inventories. These inventories result in better mapping and recording of the visual resource, which can then be used in strategic planning. Better strategic decisions lead to better operational planning and implementation, which in turn leads to a more sustainable use of the visual resource in visually important landscapes.

The Sustainability of Timber Resources:

Broad VLI mapping involve the combination of any existing field inventory data with office mapping based on local knowledge and contour interpretation. The resulting overview mapping at 1:250,000 done for each Forest District (or Planning Unit) is a necessary tool for strategic planning. However, the office portion of the broad scale mapping tends to overestimate the number of hectares being visually sensitive by including large tracks of land (e.g. from valley bottom to height-of-land) without due consideration to non visible areas caused by vegetation and landform screening. Broad mapping creates uncertainties in terms of impact on timber supply. Detailed VLIs provide a much better knowledge base to increase certainty and often result in reduced impact on timber supply compared to using broad VLIs. They allow a more precise implementation of LRMP recommendations, help refine Landscape Unit Plans, and greatly increase certainty in operational plan approval. This can also increase opportunity for certification.

The Sustainable Use of Non-timber Resources

The visual resource is a non-timber resource and the lack of adequate VLIs creates the risk of mismanaging that non-timber value. Improved knowledge through VLIs is a pre-requisite to achieving Sustainable Forest Management.

Relationship to Strategic Resource Plans and Decisions:

Strategic Decisions:

VLIs, either broad or detailed, were the first non-timber resource data to be specifically integrated and modelled in TSR1 and the refinements of many of these inventories have led to a more accurate modelling in TSR2, in addition to reducing impact on timber supply in certain areas. This trend should continue for TSR3 with an improved knowledge base and the timing for the acquisition of the VLI data will be critical in ensuring that it is integrated into the TSR3 process.

Strategic Resource Plans:

Improved VLIs also serve in the implementation of LRMP recommendations dealing with the management of scenic areas and visual quality. For many LRMPs, one of these recommendations has been to specifically undertake VLIs in areas deemed visually sensitive.

Cross Reference to Management Unit Issues:

Not applicable. Issue 12 was identified and prioritised at the regional level.

Status of Existing Knowledge:

A VLI status report and knowledge gap analysis has recently been completed for each forest district as part of the SSFM Tactical Planning Process. These status reports include the following information for each geographic area or viewshed deemed visually sensitive by current planning processes, including LRMPs, local stakeholder groups, and expert assessment:

VLI Status (Broad or Detailed)

Year VLI First Completed and Last Updated

Current Scenic Area (SA) Status (either "Known SA" as per FPC or inventory data i.e. Visually Sensitive Area)

LRMP Recommended SA Status

Current VQC/VQO Status (either established Visual Quality Objectives as per FPC or recommended Visual Quality Class)

LRMP Recommended VQC/VQO Status

Map Sheet Coverage

Cost Estimate

Target Completion Year

Priority for Acquiring New VLI Data (as set by District and Major Licensee staff)

Note: Many viewsheds are not in need for a detailed VLI for the next 5 years so the reports indicate that the priority will be re-assessed in 5 years time. However, these viewsheds will be mapped at 1:250,000 scale in the meantime.

A regional summary of the VLI status reports, including cost estimates, and prioritisation by district is attached. The analysis has confirmed the various needs for all forest districts to acquire new VLI data to better support strategic and operational planning requirements. Out of the 607 visually sensitive/scenic areas listed in these reports, 249 (or 41%) have been prioritised for detailed VLIs in the next five years.

Recommended Knowledge Solution:

General Approach:

The knowledge solution involves four initiatives, grouped into two strategies, each with 2 Tactics. Each of the initiative contributes to more effective accesses and uses of existing Visual Landscape Inventories (VLI) information as well as the collection of new VLI data to fill knowledge gaps and update old information.

Specific Solutions:

The recommended solution consists of two Strategies:

Strategy 1: Short Term VLI Strategy:

There are two tactics in the short term VLI strategy. The tactic 1 initiative is to test and recommend improvements to the provincial pilot web site containing VLI data. Tactic 2 will update the broad scale VLI mapping found on the web site for each district, based on existing data, thereby making this data available for immediate strategic and operational planning needs. Both tactics are to occur in the first year.

Strategy 2: Medium Term VLI Strategy:

There are two tactics to the medium-term VLI strategy. The tactic I initiative is to gather new and update old VLI information; the tactic 2 initiative is to upload the newly acquired data into the provincial database and web site. Due to the large number of VLI projects identified, both tactics will occur concurrently and be ongoing over the next five years.

Both strategies must be carried out for each forest district.

Organisation/Analysis/Synthesis:

Strategy 1 Tactic 1: Testing and development of a more effective use of VLI information currently available on the provincial Recreation Resources Inventory (RRI) pilot web site.

Resource Inventory:

Strategy 1 Tactic 2: Update of the broad scale VLI mapping (graphics file and database) obtained from the RRI web site for each forest district using the Standards and Procedures endorsed by RIC based on LRMP recommendations, other planning processes, and improved local knowledge.

Strategy 2 Tactic 1: Collection of new detailed VLIs and updating of old VLIs using the Standards and Procedures endorsed by RIC based on the priorities set at the local level for the next five years (see Table 3.12.1) recently completed for each forest district).

Synthesis & Extension:

Strategy 2 Tactic 2: Uploading of the newly acquired detailed VLI data into the provincial database for wide access and distribution. This phase should occur at the end of each fiscal year in keeping with the TSR 3 schedule and timeframes. This data will be initially loaded in IGDS format and subsequently translated into various formats to meet the needs of various users, including the general public. The MSRM is responsible for the data translation.

Monitoring:

Progress on accomplishments to date will be ongoing and tied to each LRMP implementation and monitoring strategies.

Strategic Performance Indicators, Targets & Milestones:

Strategic performance indicators vary by strategy. Specific information is provided in Tactical descriptions.

Relationship to other SSFM Knowledge Strategies

Completion of VLIs is also an important component of the following knowledge strategies:

SSFM 1 – Unreliable Forest Resource Inventories – specifically Recreation Features Inventory and one of its activities dealing with "viewing".

SSFM 5 - Natural Disturbance, Biodiversity and Natural Succession and how they are managed on the ground have visual implications on the landscape.

SSFM 6 - Updated VLIs are one of many decision support tools needed for Sustainable Forest Management.

SSFM 9 - Updated VLIs are one of many decision support tools needed for Pest Management.

SSFM 10 – Lack of Alternative Harvesting Experience – this experience could be gained by implementing partial cut systems in visually sensitive areas (thus achieving both objectives at once). Updated VLIs will help determine where partial cuts could occur on the land base.

Strategy 1: Short Term Visual Landscape Inventory

Tactic 1	Testing and Use of VLI Data from Recreation Resources Inventory Web Site

Tactical Summary:

Existing and new VLI data must be disseminated in a timely fashion and be easily accessible for a variety of uses and client needs. The Ministry of Sustainable Resource Management is currently piloting a provincial Recreation Resources Inventory (RRI) web site, which includes all the broad and detailed VLI data that were available for loading in the region two years ago. The main goal of this activity is to use and test this data from the web site for the purposes of developing recommendations for improvements and producing the broad scale VLI maps needed for Phase 2.

Status:

New

Tactical Objectives:

To test the RRI web site features, including the download procedures for VLI data (graphics and database);

To report any changes needed to improve access and use of the web site;

To produce customised VLI maps for each forest district for use in the update proposed in Phase 2; and,

To develop a strategy with MSRM to streamline the integration of new VLI data into the provincial database, which should include training from MSRM.

Tasks, Deliverables, Targets and Milestones (Tactical):

	Target Date
Test the various features and functions of the web site and report on potential improvements.	February 2002
Create a 1:250,000 scale map for each district showing all broad and detailed VLI data currently on the system, including contours, roads, water features, parks, etc.	April 2002
Develop a strategy with input from MSRM and users to streamline future integration of VLI data into the provincial database and web site on an annual basis or as required.	April 2002

Cost Sharing:

Possibly MoF and MSRM and in-kind contribution from both ministries.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		10 000					10 000	1

Tactic 2	Broad Scale VLI Update

Tactical Summary:

Immediate update of the VLI data found in the corporate database is needed for each district and will use the base maps produced in Phase 1 combined with any broad or detailed VLIs that have been collected since the initial upload. This update will be done using the Standards and Procedures endorsed by RIC and will include recommendations from LRMPs and other planning processes, and improved local knowledge. This broad scale update will be synchronised with the TSR 3 schedule and timeframes.

Status:

New

Tactical Objectives:

To update the VLI data obtained from the provincial database in Tactic 1 with any new VLI maps (broad and detailed) available in hardcopy and digital format from MoF (Region and Districts) and other relevant information found in LRMPs and other plans, reports, and local knowledge.

To digitise, merge, and vector clean all the graphics data for integration into the provincial database.

To produce check plots for quality control (by MoF).

To submit updated files to the Ministry of Sustainable Resource Management (MSRM) for immediate uploading into the corporate database and web site to support the TSR 3 and other planning processes.

Tasks, Deliverables, Targets and Milestones (Tactical):

	Target Date
Liaison and meeting with key individuals and groups in Region and districts to gather, delineate, map and classify all the VLI data and information available for the update and transfer to 1:250,000 topographic base map.	April 2002
Digitise, merge, and clean all the data in IGDS format for each district, including the update of the database, and complete the Visually Sensitive Area Classification Forms.	June 2002
Produce check plots for MoF's quality control and make corrections as required.	September 2002-02-18
Produce final hardcopy maps and submit digital files to MSRM	December 2002

Cost Sharing: Possibly MoF and MSRM and in-kind contribution from both ministries.								
Partnerships:								
Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		100 000					100 000	1

Strategy 2: Medium Term Visual Landscape Inventory

Tactic 1	Collection of Detailed VLI Data

Tactical Summary:

Collection of new detailed VLIs and updating of old VLIs using the Standards and Procedures endorsed by RIC based on the priorities set at the local level in the VLI status Reports. This data collection will include request for public input, fieldwork, digitising, data entry, and quality control, reports and photographs.

Status:

New

Tactical Objectives:

To gather detailed VLI in the field by identifying the portion of the landscape that is visible from various viewing locations.

To delineate Visually Sensitive Units or VSUs, which replace the broad units that were mapped in the broad scale assessment (Strategy 1, Tactic 2).

To describe each VSU in terms of existing visual condition, visual absorption capability, and biophysical and viewing characteristics, and classify it into a visual sensitivity class.

To complete a classification form for each VSU and take photographs.

Tasks, Deliverables, Targets and Milestones (Tactical):

	Target Date
Pre-field work: base data gathering, review of all relevant information (maps, plans, reports), transfer of existing alterations and administrative land legal boundaries to topographic field maps;	All 4 steps ongoing until March 2007 as per schedule and priorities set in VLI Status Reports
Public input: public input solicitation, liaison with public; and transfer of input received onto field maps, and draft report;	
Field work: confirm viewing locations and viewpoints, map visibility line, map any vegetative and topographic screening, identify key landscape features with arrows, delineate and classify VSUs, complete the VSU Classification Forms, take photographs of each VSU, and retain records of all data, information and opinions gathered in the field;	
Post field work: plot sight-lines, clean-up field maps for clarity and completeness, digitise all the map data and enter the VSU Classification Forms data into the database, produce check plots for MoF quality control, prepare final report.	

Cost Sharing:

Possibly MoF, MSRM, Forest Industry and in-kind contribution MoF for technical input and quality control.

Partnerships:

Investment to date		Investment Required[17]						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		355 000	392 000	500 000	372 000	268 000	1 887 000	5

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[17] See Table 3.12.1 for detailed district cost estimates

Table 3.12.1 Regional Summary of Issue 12, Strategy 2, Tactic 1: Acquiring new or updating existing visual landscape inventory data, 2002-2007

Forest District	Total # of Visually Sensitive/Scenic Areas Listed in 2001 VLI Status Reports based on LRMPs and other Plans	# of Visually Sensitive/Scenic Areas Requiring VLI Update based on Tactical Planning Process (%)	# of Quad Map Sheets Requiring Update (1:50,000 full-equivalency)	Cost Estimate over next 5 Years	Tentative Regional Priority based on TSR III Schedule (May 2001 Draft)
Dawson Creek	48	28 (58%)	75	$259,000	5
Fort Nelson	70	10 (14%)	58	$213,000	2
Fort St. James	152	22 (14%)	34	$472,005.00	4
Fort St. John	26	4 (15%)	24	$86,000	6
Mackenzie	66	62.99 (79%)	50,192	$1,030,010.00	3
Prince George	72	58 (80%)	102	$389,000	4
Robson Valley	87	10 (12%)	26	$101,000	1
Vanderhoof	86	65 (76%)	97	$391,000	4
Regional Total **(8 Districts)**	**607**	**249 (41%)**	**488**	**$1,837,000**	

Tactic 2	Uploading of New VLI Data into Corporate Database and Web Site

Tactical Summary:

Uploading of the newly acquired detailed VLI data into the provincial database for wide access and distribution. This phase should occur at the end of each fiscal year in keeping with the completion of detailed VLIs and TSR 3 schedule and time frames. This activity has no cost attached to it at this point since it is believed it will be a sole responsibility of the MSRM.

Status:

New

Tactical Objectives:

To ensure newly acquired VLI data are loaded into the provincial database in a timely manner to support the various planning processes.

Tasks, Deliverables, Targets and Milestones (Tactical):

	Target Date
Quality control and uploading of VLI data in IGDS format onto the provincial database and RRI web site (by MSRM). Data translation into various format to meet the needs of various users, including the public (by MSRM).	Ongoing until March 2007 as digital VLI files becomes available

Cost Sharing:

Possibly MoF and MSRM and in-kind contribution from both ministries.

Partnerships:

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		0	0	0	0	0	0	5

ISSUE 13: INADEQUATE UNDERSTANDING OF MANAGED STAND SITE PRODUCTIVITY POTENTIAL

Overview Description of the Regional Strategic Issue:

Site productivity measures are a key element in the projection of stand dynamics and yield. Several recent initiatives have identified problems with site productivity estimates in the inventory, and hinted at potential problems with height growth projections. Without an accurate means of projecting stand and ultimately forest growth, the supply of a wide range of forest values cannot be accurately determined, and meaningful efficient SFM management strategies are not possible.

Relationship to Sustainable Forest Management:

The Maintenance of Environmental Values:

The presence and distribution of a wide range of forest structures on the land base affected by the rates of harvest and subsequent development of the regenerating stands. Where the rate of harvest is high and subsequent growth rates too low to maintain adequate replacement, there will be declining presence of a wide range of desired landscape attributes. Without adequate measures of site productivity for regenerating stands, rates of harvest which will not cause such declines cannot be set with an acceptable level of confidence except using largely conservative estimates.

The Sustainability of Timber Resources:

Sustainable use of timber resources is wholly dependent on the rate of growth of the forest under different management regimes. Predicting forest growth rates and setting limits for forest harvesting in turn requires accurate estimates of site productivity.

The Sustainable Use of Non-timber Resources:

Site productivity estimates are critical for predicting the rate of development and supply of may forest attributes over time, including snag/CWD recruitment, seral stage distributions, and crown closure and understorey light levels. Accurate predictions regarding such attributes are critical to evaluating values such as wildlife habitat supply, suitable growing conditions for products such as mushrooms and berries, as well as many others.

Relationship to Strategic Resource Plans and Decisions:

Strategic Decisions:

Accurate estimates of site productivity are critical for making realistic projections of future timber supplies. AAC determinations by the Chief Forester are largely based on such projections, with important strategic implications for industrial and community stability.

Strategic Resource Plans:

Changes in predicted managed stand performance will frequently result in major changes in timber supply projections, resulting in dramatically altered perceived needs for strategic silviculture treatments. An accurate forecast of timber supply is critical for appropriate planning of silviculture investments.

Silviculture investment decisions are made on an ongoing basis, with plans changing constantly as new and better information becomes available. Silviculture investments cannot wait for "perfect" information, but where major flaws in data exist and are left unresolved, large mis-allocations of silviculture investments can occur. The currently recognised errors in site productivity estimates are a major flaw in data that could easily result in such program mis-directions.

Cross Reference to Management Unit Issues:

Uncertainty around managed stand site productivity has been cited as a major concern by the Chief Forester in the rationale statements for AAC determination in all of the management units in the Prince George Region.

Reflecting the concern of the Chief Forester, this issue has also been raised in several of the Type I Silviculture Strategies completed in the Region.

Status of Existing Knowledge:

Inventory:

Current estimates of site productivity (site index) in the forest inventory are primarily based on measures of height and age of existing stands. For use in predicting site productivity, such measures must adhere to several basic assumptions including: a) measured trees must be "top height" trees, b) they must be free of damage, and c) they must not have been suppressed or repressed. Any or all of these assumptions are frequently violated (particularly in older stands and densely populated pine stands), resulting in consistent underestimates of site productivity potential. These errors are not critical in predicting timber volumes for current stands due to the nature of the predictive tool (VDYP) used for that purpose. They become very important, however, when predicting future growth and development of stands following harvest. Improvements to the site productivity estimates in the inventory are extremely important for forest management planning.

Extension:

G&Y extension is currently provided by agencies such as SIGY, SIFERP, NIFERP, the Forest productivity Council, and MoF Research Branch.

Research and Application of Recent Innovations:

Preliminary research has confirmed that SI values in the current inventory are frequently underestimated, and methods other than height and age of current inventory polygons are appropriate for assigning site productivity estimates to the land base. For example:

work by Dr. Karel Klinka and students from the University of British Columbia has shown that Site Index can be predicted from measurable site variables (soil, terrain and climate).

the BC MoF has been developing a database (SIBEC) relating site index to the site series level of classification within the Biogeoclimatic Ecosystem Classification scheme

various techniques for mapping ecosystems on a broad landscape basis have been developed, along with methods for assigning site index values to mapped polygons

paired plot studies in lodgepole pine have demonstrated apparent differences in SI (based on height/age estimates) of 4-6 m between old stand estimates and those from adjacent young managed stands. Similar differences have been found for other species particularly when the unharvested stands are very old or have an uneven-aged character. These and associated works have led to a set of preliminary broad scale adjustments (OGSI) to SI values in the inventory to make them more appropriate for use in young managed stands.

the Growth Intercept method of estimating site index has been developed to improve measures of productivity in young stands. This method of assessment is frequently used both to assigned new SI values to young stands and to test for errors based on old stand estimates (as in the paired plot studies above). Concern has been raised, particularly for interior spruce, that these estimates may not be accurate, based on observations that different populations of young spruce have different patterns of early growth that persist beyond breast height (1.3 m). One study to date has demonstrated such bias.

Several studies from areas outside of BC have demonstrated different shapes to Height/age curves for a given species based on different soil types. Currently in BC, only a single set of curves is used for each species.

Monitoring

There has been limited use of PSP data. However as monitoring methodologies and Criteria and Indicators evolve, a segment of the current resource inventory PSP program may serve monitoring and sustainability objectives.

Recommended Knowledge Solution:

General Approach:

The knowledge solution consists of four integrated strategies:

Site Productivity Estimation

Managed Stand Yield Estimation

Growth and Yield Plot and Data Management

Each strategy addresses the collection of new data and information intended to either replace existing estimates of site productivity which are known to be flawed (inventory), or to audit/improve estimates of growth trends (growth modelling). In both cases, new information (data) is required either to test current assumptions/models or to build new models where the existing ones are proven to be flawed.

Organisation/Analysis/Synthesis:

Improved estimates of site productivity will be incorporated into the appropriate information layers of the forest inventory. These will then be used in conjunction with existing or improved height growth models in predicting yields for timber supply analysis and strategic silviculture planning, and in SFM planning and other landscape level planning processes.

Resource Inventory:

An ecosystem/terrain-based system of assigning site index values for any species to discrete land units is needed. In such a system, site index is predicted based an appropriate combination of site factors such as terrain, soil type, and ecosystem class (site series). In order for this to be successful, such site factors must be inventoried. The current methods for collecting such data include predictive ecosystem mapping (PEM) and Terrestrial Ecosystem Mapping (TEM).

Additionally, the system needs to interface with the long-standing investment in the Ministry of Forests (now Ministry of Sustainable Resource Management) Growth and Yield Permanent Sample Plot (PSPs) Program. This Program is an invaluable on-site continuous tracking of stand productivity factors (e.g. volumes/basal areas/densities per hectare, succession, in-growth, mortality). The Regional PSP Program has approximately 1500 samples on a grid matrix system (established from 1971 to 2001), scattered throughout all TSAs and TFLs. The Program consists of long-term data primarily in various natural stand types (fire origin; old growth; natural regeneration; harvesting disturbance); secondarily in limited managed and mixed species stands. Most PSPs are remeasured every ten years according to existing Growth and Yield standards and procedures (Forest Productivity Council). This resource inventory data bank, correlated to ecological associations, is a critical reference for site productivity quantification (forest estate modelling; silviculture investments; successional dynamics; carbon sequestration).

Such a system is independent of many of the limitations facing current heights and ages of forest stands (where frequently no true "top height trees" are available). Also, ecosystem units and terrain are relatively static entities, while current stand conditions including species cover (inventory type polygons) are ephemeral.

Strategies developed for ecosystem mapping and subsequent assignment of site productivity estimates must be sensitive to the need for a continuously updated landbase inventory – data collected should be useful for more refined methods of site productivity in the future rather than being useful only for a "one-off" project. Additionally these strategies need to be responsive to current growth and yield models (calibrated from PSP remeasurements), for predicting and projecting the inventory.

The existing SIBEC database likely has value in assigning productivity values to land base units, but is incomplete. Further sampling is required to make this application more broadly applicable.

Research:

Three research initiatives recommended in the short term:

Strategy 2, Tactic 1: test for bias on height growth prediction in older stands (100+ years) of lodgepole pine in then Peace River region. Practising foresters in this area have observed that stands rarely achieve the operational volumes predicted by TIPSY for a given site index. As volume production is closely correlated to height growth, a likely causal factor is that stands in this area experience a more pronounced "flattening off" of the height growth curves than is predicted in the provincial height/age curves. Such differences are typically detected by building a new set of localised curves and testing for differences. A set of 40 stem analysis plots is needed to support this work.

Strategy 1, Tactic 3, Project 1: test for bias in the estimation of site index using the growth intercept methodology on recently established (< 20 years) spruce stands. It is surmised that spruce plantations of different ages have different patterns of performance reflecting management practices, and that these differences persist beyond breast height (1.3 m). A previous study using older (> 20 years) spruce stands detected some bias, but in the opposite direction to that believed to exist for younger stands. The newer study will follow a similar methodology, but may be hampered by a lack of sufficient growth beyond breast height in the younger stands.

Strategy 1, Tactic 3, Project 2: construct growth intercept equations for aspen. Currently, there is no way to predict site index of aspen in young stands.

Monitoring:

Strategy 3, Tactic 1: continuous monitoring using existing permanent growth and yield plot networks, or those recently proposed will be useful as a check on height growth patterns.

Strategic Performance Indicators, Targets & Milestones:

Site Productivity Estimation

The ultimate target is an inventory information layer containing ecosystem/terrain based productivity estimates (site index) for discreet land units.

Tactic 1: an evaluation is required to find the most cost effective strategy for assigning site index values to mapped ecosystem units. Similar studies have been undertaken in other areas of the province, the results of which may prove useful here.

Continued sampling will also help to complete/improve the SIBEC database.

Tactic 2: field sampling and assignment of SI values, likely using SIBEC values augmented with further random sampling and use of other predictive variables.

Tactic 3, Project 1: a bias test on the interior spruce growth intercept equations will provide guidance for either acceptance of the current equations or the need either for adjustments or construction of new equations.

Tactic 3, Project 2: a growth intercept model for aspen will be built and made available for use.

Managed Stand Yield Estimation

Tactic 1: a new set of height/age curves will be produced for lodgepole pine in the Peace River area. Results of comparisons to the Provincial lodgepole pine curves will provide guidance to the need for further work.

Relationship to other SSFM Knowledge Strategies

Strategies and tactics addressing the Issue are closely linked to others that are dependent on knowledge of forest growth rates and/or which require the use of tree/stand/forest growth models. Theses include:

Issue 1 - Unreliable Forest Resource Inventories

Ecosystem mapping is a key initiative under Issue #1: Unreliable Forest Resource Inventories. Such mapping will be critical for providing the base information for ecosystem-based productivity estimates.

Issue 5 – Unknown natural disturbance, biodiversity and natural successional dynamics benchmarks

Rates of change in forest structures are a key element of predicting sustainability, influences of management on biodiversity and successional dynamics of forested landscapes.

Issue 6 – Inadequate sustainable forest management decision support tools

Rates of forest growth/change are a key element of all forest management decision support and planning systems.

Issue 8 – Incomplete understanding of boreal mixedwood stand dynamics and management objectives

Rates of forest growth/change are a key element of the dynamics of all forest stands and has a major influence on patterns of succession.

Strategy 1: Site Productivity Estimation

Tactic 1	Ecosystem Based Estimation of Site Index

Tactical Summary:

Develop and implement a strategy to collect and analyse data, predict SI values, and utilise those values within current management planning frameworks. The strategy will be developed in the first year, with data collection in subsequent years, possibly in conjunction with ecosystem map ground-truthing.

Status:

New

Tactical Objectives:

The objectives of this study are to:

identify potential predictive methods for determining SI for ecosystem-based polygons, and the data requirements for each method; efforts will be made to ensure that both near and long term needs are satisfied (assuming long term development of better predictive models)

identify data collection strategies which are both cost efficient and best satisfy the predicted data requirements.

identify use strategies for applying ecosystem-based SI values in timber supply and other resource use analyses (e.g. reconciliation of ecosystem and timber polygons for assigning yield curves)

initiate a data collection and prediction testing program based on mapped ecosystem polygons

Tasks, Deliverables, Targets and Milestones (Tactical):

Strategy document outlining data needs, a data collection strategy, and a recommending methodology for assigning SI values to ecosystem polygons (Winter 2002)

Data collection and SI value assignment for ecosystem-mapped management units within 1 year completion of ecosystem mapping (2002 through 2007).

Cost Sharing:

In-kind contribution by MoF to assist with project development, assessment and completion of reports.

Partnerships:

None identified at his time.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		15 000	75 000	75 000	75 000	75 000	315 000	5

Tactic 2	SIBEC Sampling

Tactical Summary:

Ongoing data collection toward completion of SIBEC database: adequate sampling of all commercial or potentially commercial species with significant occurrence in each site series.

Status:

Ongoing

Tactical Objectives:

Obtain acceptable estimates of mean site index for each commercial or potentially commercial species with significant occurrence in each site series, with priority given to species that currently have commercial value (location specific).

Note: MoF Research Branch is refining estimates of data needs.

Tasks, Deliverables, Targets and Milestones (Tactical):

Annual contribution of data to Provincial SIBEC database, with target of annual updates to reflect new and/or improved estimates of site index by species and site series. In the first year, an analysis based at least partly on the current Research Branch reliability assessment will be completed to focus collection efforts away from adequately represented species x site series combinations so that money is spent where it is really needed.

Cost Sharing:

In-kind contribution by MoF to assist with project development, assessment and completion of reports.

Partnerships:

None identified at this time.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		200 000	200 000	200 000	200 000	200 000	1 000 000	5

Tactic 3	Growth Intercept Methodology
Project 1	Evaluating Bias in Interior Spruce GI Equations

Tactical Summary:

Application of the current growth intercept equations for interior spruce to young stands (less than 5-10 years breast height age) suggests a high rate of occurrence of stands with very high site indices. A test is required to determine whether such high SI values really exist, or if the current equations are over-estimating SI for younger plantations. Young plantations will be sampled to compare height growth patterns with those used to build the GI equations, and thus test for bias.

Status:

New

Tactical Objectives:

Test for bias in the application of interior spruce growth intercept equations to young stands.

Tasks, Deliverables, Targets and Milestones (Tactical):

A report will be prepared describing the degree to which current growth intercept equations are suitable for use in young spruce plantations (Winter 2002).

Cost Sharing:

In-kind contribution by MoF to assist with project development, assessment and completion of reports.

Partnerships:

None identified at this time.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		20 000					20 000	1

Project 2	Trembling Aspen Growth Intercept Equations

Tactical Summary:

Produce a growth intercept model(s) that can be used to assess site index in young aspen stands.

Status:

New

Tactical Objectives:

A data set exists, collected by Karl Klinka and students at UBC, which could be used to develop a growth intercept model for aspen. Analysis work is still required

Tasks, Deliverables, Targets and Milestones (Tactical):

Analyse existing data set (summer 2002),

Produce growth intercept model(s) for aspen (summer/fall 2002), and

Publish model(s) in a field guide format (winter 2002).

Cost Sharing:

Gordon Nigh, MoF Research Branch would provide analysis as an in-kind contribution.

Partnerships:

MoF Research Branch.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		2 000	0	0	0	0	2 000	1

Strategy 2: Managed Stand Yield Estimation

Tactic 1	Height/Age Curve Validation for N.E. Lodgepole Pine

Tactical Summary:

A set of height/age curves will be developed for lodgepole pine on lacustrine soils in BWBS zone of north eastern BC. These new curves will be compared to existing provincial curves for lodgepole pine to test for local shape bias.

Status:

New

Tactical Objectives:

The objective of this study is to test for biased predictions of lodgepole pine height growth (and ultimately yield production) in northeastern BC.

Tasks, Deliverables, Targets and Milestones (Tactical):

A set of height/age curves for lacustrine soils in the BWBS zone of north eastern BC (Winter 2002)

A statistical analysis comparing the new curves with the current Provincial curves. (Winter 2002)

Cost Sharing:

In-kind contribution by MoF to assist with project development, assessment and completion of reports. Dr. Oscar Garcia of UNBC will provide an in-kind contribution of time to complete analysis of the data and to report on outcomes.

Partnerships:

MoF, UNBC

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		65 000					65 000	1

Strategy 3: Growth and Yield Plot and Data Management

Tactic 1 Maintenance and Re-measurement of Regional Growth and Yield Plots Network

Tactical Summary:

Maintaining the 10-year re-measurement cycle on the existing Growth & Yield PSPs scattered throughout the Prince George Forest Region (TFLs; TSAs; Provincial Parks; Protected Areas). This long-term tracking of G&Y attributes (species composition; site index; age/density classes; ecological association) provides a continuum of measurements for site productivity and successional dynamics. The data is used for calibrating growth & yield models (VDYP; TASS/Tipsy; MGM; Prognosis), calculating growth increments & annual allowable cuts, assessing managed stand investments, determining OAFs, and monitoring sustainable change criteria and indicators.

Status:

Ongoing

Tactical Objectives:

Maintain and perpetually enhance the existing growth & yield data repositories (Terrestrial Inventory Branch; Research Branch; University Research Forests; Growth & Yield Co-operatives).

Tasks, Deliverables, Targets and Milestones (Tactical):

Each field season, the established G&Y consulting community will carry out required mensuration activities (as per the Forest Productivity Council standards; Gyhost software procedures). PSP data due for remeasurement will be provided from the Growth & Yield Section (TIB). All work to be completed in the July-October timeframes.

Cost Sharing:

In-kind contribution by MSRM (Growth & Yield) staff to assist with data dissemination, maintenance, quality assurance, and final field checks/editing.

Partnerships:

None identified at this time.

Investment to date		Investment Required						Total Years to complete
$$	Years	$$ 2002/03	$$ 2003/04	$$ 2004/05	$$ 2005/06	$$ 2006/07	$$ Total	
		121 000	104 500	223 300	102 300	178 200	729 300	5

Ministry of Forests
and
Ministry of Water, Air and Land Protection

FOREST SERVICE
BRITISH COLUMBIA

2002 - 2006

RESOURCE MANAGEMENT PLAN

Volume III

Enhancing Environmental Values

for the
Prince George Forest/Omineca-Peace Region

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3 ENHANCING ENVIRONMENTAL VALUES

3.1 EXECUTIVE SUMMARY

The Ministry of Water, Land and Air Protection and the Ministry of Forests were contracted by Forest Renewal BC to develop a resource management plan for the Prince George Forest Region in 1999. This portion of the resource management plan (RMP) is a revised version of previous resource management plans and summarizes the Enhancing Environmental Values (EEV) component.

The EEV portion of the RMP is comprised of five (5) sections: the regional benchmark (Table 3, see Appendix) of watershed priorities as pertaining to water quality and fisheries values including recommended critical watersheds (Table 1), identification of watersheds where there is insufficient information available (Table 6) to make a determination of their priority status within the region, effectiveness evaluations (Table 5, see Appendix), a summary of consultation undertaken (see Appendix Table 1) to develop the RMP and achieve consensus with government and industry stakeholders and recommendations related to the EEV portion of the RMP. Table 4 (see Appendix) summarizes the status of existing watershed unit projects. Maps are included as Appendices 2 to 5.

It should be noted that the white sturgeon was not included in the determination of critical or high priority watersheds for the Prince George Forest Region in the 1999 draft. White sturgeon is rare and endangered in British Columbia and is one of the most critical fish species in the Province. However, due to its habitat preference (mainstems of large rivers, e.g. Fraser and Nechako as well as large tributaries to these rivers such as the Bowron River), issues relating to restoration of the habitat and conservation of the species are beyond the scope of this RMP. To avoid confusion, white sturgeon is noted as being a critical fish species, and that its habitats are of the highest priority for protection and conservation. The white sturgeon was considered a critical fish species and included in the management planning of those watersheds where they occurred in the mainstems of tributary rivers (to the Fraser for example) such as the Bowron River.

Forest Renewal BC's strategic objective for the EEV's WRP component is to restore 20% of the critical watersheds in the Prince George Forest Region by 2005. To identify the critical watersheds required to address this objective, a regional benchmark was developed. The regional benchmark identified 21 watershed units across the Prince George Forest Region for restoration by 2005. The predicted cost over the next 5 years to restore these watersheds may be in excess of what Forest Renewal BC is going to spend in the EEV program if current annual funding levels are maintained over the next 5 years. Therefore, funding will have to be increased for the program, the percentage of critical watersheds restored by 2005 decreased, or the time frame for completing restoration increased beyond 2005.

Though new assessments are not currently being supported for funding by Forest Renewal BC, watersheds where insufficient information exists to make a determination of their priority status (Category V) were identified. In total 18 watershed units were identified as having insufficient information available to determine their status. When investment is available to fund new assessments, these watersheds should be investigated as a first priority to determine their fish values and need for restoration. These category five watersheds may become the next host of key watersheds to be restored as work in target watersheds is completed.

During the summer of 2001, a request was submitted to the Watershed Restoration Technicians in each of the Forest Districts. The intent of the letter was to summon interested parties (licencees, First Nations, stewardship groups, etc) to a RMP review meeting where the content and format of the RMP was discussed. This provided an opportunity for those parties to bring forward any contrary or erroneous data or for the input of ideas, recommendations and new information. The organization of the meetings and the list of parties invited was the responsibility of the Forest District WRP Technicians.

3.2 INTRODUCTION

The Ministry of Forests and Ministry of Water, Land, and Air Protection (MWLAP) have been contracted by Forest Renewal BC to deliver an integrated Resource Management Plan (RMP) for each of the three Land Based Program components. In 2001, this RMP was put forward to the stakeholders and interested parties for a complete revision of the EEV component of the plan.

Forest Renewal BC has recently re-focused the strategic objective of the EEV program's primary component, the Watershed Restoration Program (WRP). The output of the revised objective is to restore fish habitat and/or water quality values to 20% of the critical watersheds in the province by 2005. To appreciate this objective, one must understand what is meant by a critical watershed. Forest Renewal BC developed a procedure that allows for a determination of critical watersheds through the development of a regional watershed benchmark. The regional benchmark represents a ranking of watersheds across regional areas based on fish and/or domestic water supply values and is summarized in the Forest Renewal BC document: 2002-03 Resource Management Plan Guidelines for the Watershed Restoration Program (March 2, 2001).

The requirement of this EEV RMP revision was to:

1. review the regional watershed benchmark for the Prince George Forest Region;
2. identify watersheds with insufficient information to determine their priority;
3. identify new or previously misidentified key watersheds;
4. identify the status of WRP projects for each watershed and their associated sub-basins; and
5. consult with government and industry stakeholders regarding the outputs and recommendations of these components.

The goal of the consultation process was to achieve consensus with government and industry stakeholders on the outputs and recommendations of the EEV portion of the Prince George Forest Region RMP

To revise the Prince George Forest Region EEV RMP, a committee comprised of Brendan Anderson (MWLAP), Tim Silbernagel (Ministry of Forests), and Ray Pillipow (MWLAP) was struck by the Regional RMP steering committee. The EEV RMP committee was responsible for gathering information required to develop the plan, oversee the recommendations for critical watersheds, for soliciting input from government and industry stakeholders, and for compiling the output of all information gathered into a report for submission to the Regional RMP steering committee.

3.3 REGIONAL BENCHMARK

The regional benchmark was developed following the six step process outlined in the 2002-03 Resource Management Plan Guidelines for WRP (March 02, 2001). The regional benchmark has been included with this revision of the RMP, considered essential information to the reader in understanding the framework of this RMP.

Step 1. Identify Fish Species and Critical Stocks of Importance to the Prince George Forest Region

Meetings were held with Ministry of Fisheries staff and Ministry of Water, Land, and Air Protection staff form the Omineca - Peace region to determine what the species of interest and the critical stocks were for the purposes of this plan. Department of Fisheries and Oceans staff comment and input was solicited and where available included in this step. Reference was also made to salmon watershed planning profile developed by Department of Fisheries and Oceans for planning exercises such as this RMP.

Critical species for the Prince George Forest Region are (two or three letter codes following species name represent RIC codes included on summary tables):

Arctic grayling (GR)
bull trout (BT)
specific stocks of lake trout (LT)
specific stocks of kokanee (KO)
brassy minnow (BMC)
pearl dace (PDC)
goldeye (GE)
pygmy whitefish (PW)
inconnu (IN)
specific runs of chinook salmon (CH)
coho salmon (CO)
specific stocks of northern pike (NP)

white sturgeon (WSG)
Dolly Varden (DV)
specific stocks of rainbow trout (RB)
westslope cutthroat trout (WCT)
chiselmouth chub (CMC)
fathead minnow (FM)
spoonhead sculpin (CRI)
round whitefish (RW)
lake cisco (CL)
specific runs of sockeye salmon (SK)
steelhead (ST)
specific stocks of walleye (WP)

The species listed above represent provincially red- or blue-listed species, or species that are important from a First Nations, sustenance, commercial, or recreational fishery perspective.

The results of this step were presented to government and industry stakeholders for input. Several watersheds had a variety of additional species to be included in the plan.

Step 2. Adopt a Base Map for the Region:

A suitable base map for the Prince George Forest Region had to be developed that was at a broad enough scale to ensure some level of information was available for each watershed, yet not so broad as to lump high and low priority fish and domestic water supply areas together.

The fish assessment unit and landscape unit maps developed for the LRMP process in each of the 8 forest districts in the Prince George Forest Region provided a map base that met these criteria. Fish assessment units are landscape units modified to isolate areas of high (or low) fish values (e.g. areas of watersheds upstream of impassable barriers are separated from fish bearing areas). Fish assessment map bases were available for Prince George, Vanderhoof, Fort St. James, Robson Valley and Mackenzie Forest Districts. As fish assessment unit maps were not available for the Peace Sub-Region, landscape unit maps were used instead for the Dawson Creek, Fort St. John and Fort Nelson Forest Districts.

A further advantage of using fish assessment and landscape unit maps was that information on fish species distribution and importance had already been compiled for the various LRMP tables. Thus we were able to transfer information on fish values from the LRMP to the Forest Renewal BC RMP process. By maintaining our map base consistently with that of the various district LRMP's, information developed from this planning exercise will also be available for future LRMP use at meetings and or updates.

As some of the Target watersheds have changed and Transition watersheds are no longer a part of the Plan, the maps associated with the Plan had to be updated. Because the two sub-regions were using different coverages (fish assessment base maps vs. landscape unit maps), the RMP committee agreed that the best option was to have each Sub-Region complete their own map. The Omineca maps and the Peace maps are therefore submitted as separate appendices. For each of the sub-regions there are two maps, one showing all of the Fish/Landscape Units and their regional priorities for fish and domestic water supply and the other highlighting the Priority Key and Target watersheds.

The Fish Assessment and Landscape Unit maps identified 355 watershed units within the Prince George Forest Region. Watershed units were added to Fort Nelson (14) district and Dawson Creek (1) district due to changes in district boundaries. On a district by district breakdown, watershed units were identified as follows:

Prince George District:	47 units
Vanderhoof District:	19 units
Robson Valley District:	25 units
Fort St. James District:	44 units
Mackenzie District:	56 units
Dawson Creek District:	35 units
Fort St John District:	43 units
Fort Nelson District:	83 units
Total	**355 units**

Average size of the watershed units is 90,000 Ha, with a minimum of 276 Ha and a maximum of 406,000 Ha.

Step 3. Select Watersheds as Delineated in Step 2 that contain Species/Stocks /Runs and or Important Producers or Conservation Streams for Species Identified in Step 1:

In the original draft, watershed units were reviewed with Ministry of Water, Land, and Air Protection's staff to identify which watersheds contained species, stocks, or runs, or were important producers or conservation streams for the species identified in Step1. This information has been refined and updated with each of the subsequent revisions. Department of Fisheries and Oceans staff were solicited for input but due to workload and timing concerns were not available to provide detailed comments on this stage of the benchmark. However, reference was made to the Salmon Watershed Planning Profiles for the Fraser River Basin developed by the Department of Fisheries and Oceans staff for planning exercises such as this.

A note on White Sturgeon:

One species which had to be considered in a unique manner was the White Sturgeon. White Sturgeon reside in the mainstem portions of large river systems such as the Fraser, Nechako, Bowron, McGregor, and Stuart Rivers. As well, they reside or utilize portions of some major tributaries to these large rivers (e.g. Lower Torpy R). Where white sturgeon reside in these major tributaries, the species was considered in determining the regional priority for fish value. Where *the White Sturgeon was found only in the mainstem portions of these large rivers (i.e. Fraser R, Nechako R, etc) the species was not considered in determining the regional priority for fish values. This was done to prevent elevated regional priorities from the presence of white sturgeon in large rivers that are associated with many different fish units.*

Step 4. Identify Significant (>15 licenses) Domestic Water Supply and Forest Practices Code (FPC) Community Watersheds:

Once Step 2 was completed, meetings were scheduled with Ministry of Water, Land, and Air Protection's Water Management Branch staff to identify domestic water supply and FPC community watersheds.

Priority for domestic water supply was assigned to all 355 watersheds in the Prince George Forest Region. FPC community watersheds were listed as Very High Priority, as were watersheds with more than 25 domestic water supply licenses. Watersheds with 15 to 25 domestic water supply licenses were identified as High Priority, 5 to 14 as medium and less than 5 as low priority.

The format for domestic water supply ranking and prioritization did not change in the 2001 revision.

There was also a subjective component to this evaluation which helped to identify those watersheds with a low number of licenses but a large population of users.

The regional breakdown of domestic water supply priorities in the 2002-03 RMP revision is as follows:

9 Very High

3 High Priority

31 Medium

312 Low

The low numbers of domestic water supply priorities in the Prince George Forest Region is due to the lack of FPC community watersheds compared with other regions and the their numbers of subterranean domestic water supplies.

Step 5. Prioritize the Watersheds according to their fisheries resource values:

All 355 watersheds in the Prince George Forest Region were ranked according to their importance for the identified fish species from Step 1. The recommended procedure for ranking watersheds was as follows:

Very High priority watersheds;
contain endangered, or unique species or stocks, or contain two or more high value stocks or targeted species with conservation concerns.

High priority watersheds;
contain one threatened, sport, or regionally significant species.

Medium priority watersheds;
contain all other fish bearing watersheds

Low priority watersheds;
are non-fish bearing.

At the regional level in the 2002-03 RMP revision, watersheds were divided up as follows according to their fisheries values:

155 Very High
120 High

69 Medium
11 Low
355 Total

A guideline of the Resource Management Planning process was that no more than 25% of watersheds should be ranked as the highest category. The number of very high ranking watersheds identified in the 2002-03 draft exceeds this at 43.7 % (155/355 watersheds). However, this is seen as unavoidable since the methodology was applied consistently across watersheds.

Step 6. Estimate the Status of Impact and Potential for Restoration for Each of the Ranked Watersheds:

Following the completion of Steps 4 and 5, all watersheds in the Prince George Forest Region were identified in 1 of 6 categories based on their history of resource development. The following summarizes the 6 categories:

> Category I: watersheds have known impacts from pre-FPC forestry that will potentially benefit from restoration activities.
>
> Category II: watersheds have impacts from pre-Code forestry as well as other land uses (including private land) and where there is a coordinated restoration plan in place.
>
> Category IIB: watersheds with significant impacts from other land use (including private lands) but where there is no coordinated restoration plan in place.
>
> Category III: watersheds with minimal or no pre-FPC forestry impacts.
>
> Category IV: watersheds that have been impacted to such a degree by pre-FPC forestry that restoration effort is unlikely to be successful or cost-effective.
>
> Category V: watersheds with insufficient information to determine their status of impact.

Watersheds were assigned categories based on consultation with Ministry of Forests, Ministry of Water, Land, and Air Protection, and licensees.

3.4 RECOMMENDATIONS OF CRITICAL WATERSHEDS FOR RESTORATION BY 2005

The strategic target identified by Forest Renewal BC for the EEV's WRP component is to restore 20% of the Very High priority or critical watersheds for fish or domestic water supply values by 2005. As 106 watersheds were identified as Category 1 watersheds with known impacts from pre-code forestry and an expected benefit from restoration activities, 20% of these equates to a total of 21 watersheds being recommended for restoration by 2005.

From the 355 watersheds in the Prince George Forest Region, 275 were identified as key watersheds - high or very high values for fish species or domestic water supply. Of those, 34 are identified as Priority Key watersheds. The number of Target watersheds from last year has dropped to 20. This number is just under the allowable 20% as detailed above. It is expected, that as works in Target watersheds are completed, other Priority Key watersheds will be ramped up and eligible for restoration funds.

Table 1 and the accompanying maps summarize the 20 watersheds recommended for restoration by 2005 to meet Forest Renewal BC's strategic target and Table 2 provides a breakdown of each watershed within the region.

Table 1. Omineca-Peace Strategic Watersheds

Unit #	MOF District	Watershed Unit	Regional Priority for Domestic Water Supply (VH,H,M,L)	Regional Priority for Fish (VH,H,M,L)	Existing Fish Species and Populations at Risk	Categories I-V	Category II Issues	Priority Key Watershed for Region (Y/N)	MYA# and/or Name of Implementing Partner	Target Watershed
12	Robson Valley	Holmes	L	VH	BT, RB, CH	1		Y	OPA012101	Y
18	Robson Valley	McBride / Dunster	VH	H	BT, CH	1		Y	OPM02604	Y
48	Fort St James	Chuchi	L	VH	GR, LT, RB unique	1		Y	OPM02504	Y
94	Prince George	Bowron	L	VH	BT, SK, CH, WSG, RB	1		Y	OPM01103	Y
130	Prince George	Table	L	VH	GR, BT, RB	1		Y	OPM01103	Y
131	Prince George	Torpy (lower)	L	VH	BT, CH, WSG	1		Y	OPM01103	Y
132	Prince George	Torpy (upper)	L	VH	BT, LT, CH, WSG	1		Y	OPM01103	Y
135	Prince George	Willow	L	VH	BT, LT, KO, Eaglett Lk sustenance, CH	1		Y	OPM01103	Y
160	Mackenzie	Mesilinka (lower)	L	VH	GR, BT	1		Y	OPM01603	Y
162	Mackenzie	Misinchinka	L	VH	GR, BT	1		Y	OPM01603	Y
164	Mackenzie	Nation	L	VH	GR, BT	1		Y	OPM02604	Y
167	Mackenzie	Osilinka (lower)	L	VH	BT, GR, LT	1		Y	OPM01603	Y
174	Mackenzie	Philip	L	VH	BT, GR, KO	1		Y	OPM02604/Slocan Mack	Y
200	Fort St John	Colt Creek	M	VH	BT, GR, RB	1		Y	OPM01803	Y
214	Fort St John	Kobes Creek/Groundbirch Cr.	M	VH	BT, GR, RB	1		Y	OPM01803	Y
243	Dawson Creek	Gething	L	VH	BT, GR, RB	1		Y	OPM01703	Y
245	Dawson Creek	Hasler	M	VH	BT, GR, RB	1		Y	OPM01703	Y

258	Dawson Creek	Pine Pass	M	VH	BT, GR, RB	1		Y	OPM98705	Y
265	Dawson Creek	Upper Sukunka	L	VH	BT, GR, RB	1		Y	OPM98705	Y
268	Dawson Creek	Wolverine	L	VH	BT, GR	1		Y	OPM01703	Y
					Poroposed Future Target Watersheds					
246	Dawson Creek	Imperial	L	VH	BT	1		Y		N
301	Fort Nelson	Kledo	L	VH	BT, GR	1		Y		N
303	Fort Nelson	Klua	L	VH	WP,NP,MW,GR	1		Y		N
334	Fort Nelson	Stanolind	L	VH	GR,WP,NP	1		Y		N
50	Fort St James	Driftwood (upper)/ Kostine	L	VH	BT, CH, SK	1		Y		N
141	Mackenzie	Davis	L	VH	GR, BT	1		Y		N
107	Prince George	Hominka	L	VH	GR, BT	1		Y	OPM01103	N
115	Prince George	Missinka	L	VH	GR, BT	1		Y	OPM98111	N
122	Prince George	Parsnip (upper)	L	VH	BT	1		Y	OPM98111	N
19	Robson Valley	Milk	L	VH	BT, CH, WSG	1		Y		N
25	Robson Valley	Trench (South)	VH	H	BT, CH	1		Y		N
38	Vanderhoof	Nithi	M	VH	stellako RB, SK, CH, BB, KO	1		Y		N
					Completed Target Watersheds					
1	Robson Valley	Camp Creek	L	VH	BT, yellow fin RB	1		Y	OPM98304	Completed
175	Mackenzie	Russell	L	VH	GR, BT	1		Y	OPM01603	Completed

Table 2. Classification of Omineca-Peace Priority Benchmark Watersheds

	Watershed Classification	Number of Watershed Units
1	Key Watershed units that are Category 1	106
2	Key Watershed units that are Category 2	0
3	Key Watershed units that are Category 2b	31
4	Key Watershed units that are Category 3	158
5	Key Watershed units that are Category 4	1
6	Key Watershed units that are Category 5	16
7	Number of Key Watershed Units (Sum of key categories 1-5)	312
8	Total Number of Priority Key Watershed Units	34
9	Total Number of Watershed Units (including key and non-key)	355

3.5 TRANSITION FUNDING

Through the shifting focus of Forest Renewal's EEV objectives, a number of non-critical watersheds that have received WRP investment in the past are no longer eligible for funding. These watersheds were identified as Transition Watersheds as they had a transitional period during which final works could be completed. However, to truly complete works in these watersheds and to capitalize on learning opportunities, effectiveness evaluations of past works are still being conducted.

Outside of these effectiveness evaluations and potential maintenance needs, activities within Transition watersheds are considered complete throughout the region. Proponents in each of the districts were aware of the transition funding criteria and were to have implemented works in the 2000-2001 fiscal year. Those that did not are also aware that the opportunity to conduct works in these watersheds in the remaining years of the plan is no longer available. FRBC has identified the need to apply final adjustments to the projects funded under transition monies and, as a result, will fund "hotspot" projects where the need arises.

3.6 WATERSHEDS WITH INSUFFICIENT INFORMATION TO MAKE A PRIORITY RECOMMENDATION (CATEGORY V WATERSHEDS)

The formulation of the regional benchmark indicated watershed units within the Prince George Forest Region where there is insufficient information available to make a priority determination. The information gaps are due either to a lack of fish inventory, habitat/impact assessment, or pre-

FPC harvesting information. These watersheds have been identified as Category V watersheds and are summarized in Table 6.

In total there are 18 Category V watersheds in the Prince George Forest Region, of which will be reduced to a total 15 Category V watersheds by the end of the 2001/02 fiscal year. As the fish values or potential for restoration in these watersheds is unknown, broad overview assessments or reconnaissance visits should be undertaken in them in the near future. This will allow the watersheds to be properly integrated into the regional benchmark.

Table 6. Category V Watersheds

Watershed #	MOF District	Watershed Unit	Regional Priority for Domestic Water Supply (VH,H,M,L)	Regional Priority for Fish (VH,H,M,L)	Existing Fish Species and Populations at Risk	Categories I-V	MYA# and/or Name of Implementing Partner
49	Fort St James	Cunningham	L	H	BT, SK, LT	5	
63	Fort St James	Middle A	L	VH	KO, BT, DV, SK, CH	5	OPM02504
64	Fort St James	Middle B	L	VH	KO, BT, LT, DV, SK, CH	5	OPM02504
81	Fort St James	Tachie River	L	VH	unique RB, SK, CH	5	OPM02504
88	Fort St James	Whitefish	L	M	RB, LT	5	
89	Prince George	Anzac	L	VH	BT, GR, RB, KO	5	
93	Prince George	Blackwater	L	H	RB, CH	5	
96	Prince George	Carp	L	H	RB McLeod R., BT	5	
121	Prince George	Parsnip (lower)	L	VH	BT, GR, LT	5	
123	Prince George	Reynolds	L	VH	GR, BT, RB	5	
129	Prince George	Stuart	L	H	CH, SK, BT, WSG	5	OPM01103
205	Fort St John	Farrell Creek	M	H	GR, RB	5	
210	Fort St John	Horseshoe/Bluegrave	M	VH	BT, GR, RB	5	
238	Dawson Creek	Burnt River	L	VH	BT, GR, RB	5	
239	Dawson Creek	Carbon	L	VH	BT, GR, RB	5	
264	Dawson Creek	Upper Moberly	H	VH	BT, GR, RB	5	OPM98705
269	Fort Nelson	Akue	L	VH	GR,WP	5	
305	Fort Nelson	Kyklo	L	M		5	

3.7 EFFECTIVENESS EVALUATIONS

As part of the 2002-03 RMP for EEV, each region has been directed to identify or recommend priority needs for intensive effectiveness evaluations (IEE's) and operational technique refinements (OTR's). To this end, the EEV committee solicited input from the MoF District Technicians and industry stakeholders. While the Committee recognizes the importance of evaluating restoration works to ensure that the current techniques and implementation practices are effective, time constraints and the relatively short history of the Program in this Region have limited the number of submissions. Table 5 contains the Prince George Forest Region IEE or OTR recommendations.

3.8 STAKEHOLDER CONSULTATION

Direction for the revision of the EEV RMP was obtained from the March 2nd, 2001 document '2002-03 Resource Management Plan Guidelines for the Watershed Restoration Program'. In efforts to revise last year's version of the EEV RMP, district meetings were held with the MoF District Technicians, proponents/licensees, and other interested parties. Each of the WRP technicians in each of the MoF district offices was requested to organize a meeting on a specified date with all interested parties and vested interest groups. Identifying and contacting the proponents, stewardship groups, First Nations, interest groups, MoF and MWLAP representatives, etc was the responsibility of the district WRP technicians. The intent of the meeting was to review the 2001-02 version of the RMP and to solicit any additional, contrary, or otherwise pertinent information that would be useful in revising the plan. Tables 3 to 5 were outlined as the format for the revised RMP and completed tables were compiled for each of the districts.

A date of August 31st, 2001 was given as the deadline for submission of any additional, contrary, or otherwise pertinent information. Meeting details that include: attendance lists, dates, times, and issues were kept and are presented in Appendix 1.

3.9 LIMITATIONS AND ISSUES OF CONCERN OF THE EEV RMP

As the Prince George Forest Region EEV RMP has been revised, a number of issues have been raised by government and forest industry stakeholders each year. Limitations and issues of concern of the EEV component of this RMP, as presented by the forest industry stakeholders and the Government Steering Committee members, are summarized as follows:

3.9.1 HOT-SPOT FUNDING

Annual funding for restoration works in non-priority watersheds was another issue raised to the EEV RMP steering committee. There are currently licensee, district and even regional scale projects that have been funded by Forest Renewal BC over the previous years that identify 'hot-spot' areas to undertake watershed restoration works. These 'hot spots' are comprised mainly of stream crossings (typically culverts) that block fish passage, and road failures or landslides attributable to pre-FPC forest harvesting activity. In previous years, eligible projects have been funded by Forest Renewal BC on an annual basis regardless of location.

With the current delivery model of WRP these projects may be funded only on a case-by-case basis and if they satisfy a restrictive list of requirements. In the Omineca-Peace FRBC has limited the usage of hotspot funding to within Target watersheds. Previous work has shown that up to 80% of culverts on fish bearing streams are barriers or partial barriers to fish passage in the Omineca-Peace, with thousands of kilometers of fish habitat isolated upstream of them. In some districts, re-establishing fish passage is the highest priority restoration work to be completed. While some of these areas of concern may be addressed through road deactivation, efforts should be made to directly manage these issues.

> *Target/Key watershed management excludes the majority of fish passage opportunities. Fish passage restoration is arguably the most cost-effective and low-risk form of restoration activity. Where appropriate opportunities exist, these sites should be considered as a high priority in their own right, regardless of location.*

The EEV RMP Steering Committee strongly recommends that Forest Renewal BC develop a strategy to identify, prioritize and fund issues such as stream crossing and road failure projects in non-critical watersheds on a large-scale and annual basis. Forest Renewal funds expensive habitat creation and channel stabilization within small scale selected areas, while thousands of kilometers of natural habitat remain inaccessible from point source blockages.

3.9.2 RMP TIMING

There was essentially poor attendance in the Omineca sub-region for RMP planning sessions. The consensus from those involved in both the Omineca and Peace sub-regions was that the timing of planning sessions should not occur within the field season, nor should final deliverables be required in the early fall, on the heels of the field season.

> *To allow for resource management planning issues to be addressed more efficiently, district "Watershed Technical Committee" (WTC) meetings that currently exist for project development issues in the Omineca sub-region, may allow for a continual update of watershed unit project status (Table 4 updates).*

3.9.3 WATERSHED UNIT BOUNDARIES

Watershed unit boundaries for the region have been adopted from pre-existing Fish Unit boundaries in the Omineca and Landscape Unit boundaries in the Peace. For the most part, using these standardized units has facilitated the planning process. However, these boundaries do not always align with areas of interest from an EEV perspective and have therefore been amended.

3.10 RECOMMENDATIONS

1. As discussed in #1 of the previous section, numerous culverts that are impassable to fish are found over the majority of each forest district. Under the new delivery model of the EEV component, these problem areas cannot be addressed unless they happen to be within a Target watershed. To fund the restoration of impassable fish culverts outside of Target watersheds with 'hotspot' funding under-estimates the size and importance of this problem.

   The decision to utilize FRBC funding for a fish passage project outside of a Target watershed should be made at the agency level based on the individual merits of the project.

   The monies spent on this type of restoration would provide the greatest efficiency and benefit per cost because natural unused habitat is being reclaimed.

   > *Road eligibility guidelines as it pertains to fish passage concerns needs to be reviewed to determine whether there are restrictive policies that preclude the development of stakeholder partnerships, thereby eliminating eligibility to documented fish passage problems.*

2. Of the 355 watersheds in the Omineca-Peace region, 18 are listed as Category 5. For this Plan to be effective at identifying all of the Key watersheds, the status of these category 5 watersheds must be known. It is recommended that annual funding be made available to assess the remaining Category 5 watersheds and re-categorize them appropriately. Until the correct status of these watersheds is known, they cannot be eliminated for the possibility of becoming Key watersheds, and will continue to be an annual resource management planning (RMP) issue.

3. Although there is a Regional Benchmark system in place to identify and priorize Key watersheds, there should be some means of identifying those watersheds that are important to each district where no Key watersheds have been identified. To date, only the Vanderhoof district is experiencing the socio-economic implications of the Program ceasing in that area, however, the potential exists for other districts to be eliminated from the Program as a result of the current delivery model. Understanding that the program is fish species and domestic water supply driven, there should be some continuation of the Program in districts where no Key watersheds are identified.

3.11 ENHANCING ENVIRONMENTAL VALUES APPENDIX

Appendix Table 1. **Consultation Summary**

Meeting Location: Prince George	**Date:** June 19, 2001	**Time:** 09:00
Attendees: Mike Darin – Ministry of Forests, Prince George Dyon Armstrong – Dunkley, Prince George (Harvesting Technician) Tim Silbernagel – Ministry of Forests – region, Prince George Ray Pillipow – Ministry of Water, Land, and Air Protection– region, Prince George		
Meeting Location: McBride	**Date:** June 20, 2001	**Time:** 10:00
Attendees: Peter Wright - Ministry of Forests, McBride Norma Stromberg-Jones - Ministry of Forests, McBride/ FRBC Coordinator Marty Rombough – Slocan Forest Products Ltd. Valemount Dutch Molendyk – McBride Forest Industries/ General Manager Craig Pryor – McBride Forest Industries/ FRBC Coordinator Tim Silbernagel – Ministry of Forests – region, Prince George Ray Pillipow – Ministry of Water, Land, and Air Protection– region, Prince George		
Meeting Location: Fort St. James	**Date:** July 04, 2001	**Time:** 10:30
Attendees: Laurie Pletzer - Ministry of Forests, Ft St James Earl Wilson - Ministry of Forests, Ft St James/ FRBC Coordinator Tim Silbernagel – Ministry of Forests – region, Prince George Ray Pillipow – Ministry of Water, Land, and Air Protection– region, Prince George Barry Thorpe – Canfor Fort St. James/ FRBC Coordinator		
Meeting Location: McKenzie	**Date:** July 03, 2001	**Time:** 10:30
Attendees: Leslie Yaremko (supplied written input) – Slocan Forest Products Ltd. Micheline Snively - Donohue Forest Products Inc. Jeff Kotowsky - Ministry of Forests, McKenzie Tim Silbernagel – Ministry of Forests – region, Prince George Ray Pillipow – Ministry of Water, Land, and Air Protection– region, Prince George		
Meeting Location: Vanderhoof	**Date:** July 05, 2001	**Time:** 09:20
Attendees: Tim Silbernagel – Ministry of Forests – region, Prince George Ray Pillipow – Ministry of Water, Land, and Air Protection– region, Prince George Ken Chalmers - Ministry of Forests/ Small Business/ Silviculture Forester/ Vanderhoof Vince Sewell - Ministry of Forests/ Engineering Officer/ Vanderhoof		
Meeting Location: Dawson Creek	**Date:** July 9, 2001	**Time:** 9:00
Attendees: Kevin Hanna - Ministry of Forests, Ft St John Tim Silbernagel – Ministry of Forests, Prince George Brendan Anderson - Ministry of Water, Land, and Air Protection, Fort St John Andrew deVries – Chetwynd Division of Canadian Forest Products Brian Pate – Chetwynd Forest Industries		
Meeting Location: Fort St John	**Date:** July 10, 2001	**Time:** 9:00
Graham Anderson - Ministry of Forests, Ft St John Tim Silbernagel – Ministry of Forests, Prince George Brendan Anderson - Ministry of Water, Land, and Air Protection, Fort St John Jim Schilling – Fort St John Division of Canadian Forest Products		
Meeting Location: Fort Nelson	**Date:** July 11, 2001	**Time:** 9:00
Jeff Cran – Ministry of Forests, Ft St John Tim Silbernagel – Ministry of Forests, Prince George Brendan Anderson - Ministry of Water, Land, and Air Protection, Fort St John Kevin Kuhn – Fort Nelson Division of Slocan		

Appendix Table 3. Regional Benchmark Priority Watersheds, based on Water Quality and Fisheries Value.

Unit #	MOF District	Watershed Unit	Regional Priority for Domestic Water Supply (VH,H,M,L)	Regional Priority for Fish (VH,H,M,L)	Existing Fish Species and Populations at Risk	Categories I-V	Category II Issues	Priority Key Watershed for Region (Y/N)	MYA# and/or Name of Implementing Partner	Target Watershed
1	Robson Valley	Camp Creek	L	VH	BT, yellow fin RB	1		Y		
2	Robson Valley	Canoe	L	M	BT	3		N		
3	Robson Valley	Caribou	L	M	BT	3		N		
4	Robson Valley	Castle	L	M	BT	1		N		
5	Robson Valley	Crescent Spur	L	H	BT, CH	1		N		
6	Robson Valley	Dawson	L	M	BT	1		N		
7	Robson Valley	Dore	L	M	BT	1		N	OPM02604	
8	Robson Valley	East Twin/McKale	L	H	BT, CH	1		N		
9	Robson Valley	Forgetmenot	L	H	BT, CH	3		N		
10	Robson Valley	Foster	L	M	BT	1		N		
11	Robson Valley	Goat	L	H	BT, CH	3		N		
12	Robson Valley	Holmes	L	VH	BT, RB, CH	1		Y	OPA012101	Y
13	Robson Valley	Horsey/Small	L	M	BT	1		N		
14	Robson Valley	Hugh Allan	L	H	BT	1		N		
15	Robson Valley	Kinbasket (east)	L	M	BT	1		N		
16	Robson Valley	Kinbasket (west)	L	L	RB, Saddle lakes	1		N		
17	Robson Valley	Kiwa/ Tete	L	M	BT	1		N	OPM02604	
18	Robson Valley	McBride / Dunster	VH	H	BT, CH	1		Y	OPM02604	Y
19	Robson Valley	Milk	L	VH	BT, CH, WSG	1		Y		
20	Robson Valley	Morkill (lower) / Cushing	L	H	BT, CH	1		N		
21	Robson Valley	Morkill (upper)	L	L	N	1		N		
22	Robson Valley	Mount Robson	L	H	BT, CH	3		N		
23	Robson Valley	Raush	L	M	BT	2b	Agriculture	N		
24	Robson Valley	Trench (Northern)	L	H	BT, CH	1		N		
25	Robson Valley	Trench (South)	VH	H	BT, CH	1		Y		N
26	Vanderhoof	Blackwater	L	H	unique RB	3		N		

27	Vanderhoof	Chilako	L	M	CH, CO, BB RB	1		N		
28	Vanderhoof	Cluculz	L	H	LT, KO, CH, BB, RT, MW	2b	agriculture	N		
29	Vanderhoof	Endako	M	VH	stellako RB, SK	2b	agriculture	N		
30	Vanderhoof	Entiako	L	L	N	1		N		
31	Vanderhoof	Fawnie	L	M	lg DV, sustenance fish	3		N		
32	Vanderhoof	Greer	M	H	chief grey, hobson, CH	2b	agriculture	N		
33	Vanderhoof	Hallett	L	M	LT, KO	1		N		
34	Vanderhoof	Jerryboy	L	L	N	1		N		
35	Vanderhoof	Kluskus	L	M	KO, RB	1		N		
36	Vanderhoof	Lucas	L	M	KO, RB	1		N		
37	Vanderhoof	Nechako	VH	VH	BMC, CH, SK, BT	2b	agriculture & Hydro	N		
38	Vanderhoof	Nithi	M	VH	stellako RB, SK, CH, BB, KO	1		Y		
39	Vanderhoof	Sinkut	M	M	CH	2b	agriculture	N		
40	Vanderhoof	Stony	M	M	RB, sustenance FN	2b	first nation, agriculture	N		
41	Vanderhoof	Stuart	L	H	CH, SK	1		N		
42	Vanderhoof	Sutherland	L	VH	unique RB, SK, KO	3		N		
43	Vanderhoof	Tatelkuz	L	M	KO, RB	1		N		
44	Vanderhoof	Tatuk	L	M	KO	1		N		
45	Fort St James	Asitka/Willow	L	VH	ST, SK, CO, BT	3		N		
46	Fort St James	Bear Lake	L	VH	ST, CH, SK, CO	2b	railway	N		
47	Fort St James	Beaver/Salmon	L	H	CH, RB	1		N		
48	Fort St James	Chuchi	L	VH	GR, LT, RB unique	1		Y	OPM02504	Y
49	Fort St James	Cunningham	L	H	BT, SK, LT	5		N		
50	Fort St James	Driftwood (upper)/ Kostine	L	VH	BT, CH, SK	1		Y		
51	Fort St James	Dust Creek	L	H	SK	3		N		
52	Fort St James	Duti River	L	VH	ST, CO	2b	mining	N		
53	Fort St James	East Takla Lake	L	H	BT, SK	1		N		
54	Fort St James	Fall/Silver	L	VH	GR, BT, DV	2b	mining	N		
55	Fort St James	Fort St James	L	L	N	2b	urban development, hwys, agriculture	N		

56	Fort St James	FryPan	L	H	BT, KO, SK	1		N		
57	Fort St James	Grostete/Hat	L	H	small lake LT, SK, CH	1		N		
58	Fort St James	Inzana	L	M	LT	1		N		
59	Fort St James	Klawli	L	M	BT, RB, DV	2b	mining	N		
60	Fort St James	Kluatantan	L	H	ST, CO,SK, BT	3		N		
61	Fort St James	Lion / Katsberg	L	H	KO, BT, SK	1		N		
62	Fort St James	Lovell	L	H	KO, BT, SK	1		N		
63	Fort St James	Middle A	L	VH	KO, BT, DV, SK, CH	5		N	OPM02504	
64	Fort St James	Middle B	L	VH	KO, BT, LT, DV, SK, CH	5		N	OPM02504	
65	Fort St James	Nation (North)	L	M	LT	2b	mining	N		
66	Fort St James	Necoslie	L	L	N	2b	agriculture & urban development	N		
67	Fort St James	Omineca Headwaters	L	M	BT, GR, DV	3		N		
68	Fort St James	Ominicetla	L	H	GR, BT	3		N		
69	Fort St James	Pinchi	L	M	CH, KO	2b	mining	N		
70	Fort St James	Sakenichie	L	H	BT, KO, SK	1		N		
71	Fort St James	Salmon (North)	L	M	CH	1		N		
72	Fort St James	Skeena	L	VH	ST, CH, SK, CO	3		N		
73	Fort St James	Skeena Headwaters	L	VH	ST, CH, CO	2b	mining & railway	N		
74	Fort St James	Skeena/Mosque	L	VH	ST, CH, SK, CO	2b	railway	N		
75	Fort St James	Skeena/Sustut	L	VH	ST, CH, SK, CO	2b	railway	N		
76	Fort St James	Slamgeesh	L	H	CH, SK, CO	3		N		
77	Fort St James	Sowchea	L	M	SK, KO	2b	Ag & Hwy	N		
78	Fort St James	Squingula	L	VH	BT, RB, SK, CO	3		N		
79	Fort St James	Stuart River	L	H	SK, CH, WSG	2b	Agriculture	N		
80	Fort St James	Sustut Lake	L	VH	ST, SK, CH, CO	3		N		
81	Fort St James	Tachie River	L	VH	unique RB, SK, CH	5		N	OPM02504	
82	Fort St James	Tchentlo 25	L	H	BT, LT	2b	mining	N		
83	Fort St James	Tchentlo 27	L	H	BT, LT	1		N		
84	Fort St James	Tezzeron	L	M	LT	1		N		
85	Fort St James	TFL42	L	L	N	1		N		

86	Fort St James	Upper Birdflat	L	VH	ST, CO, BT	3		N		
87	Fort St James	Upper Sustut	L	VH	ST, SK, CH, CO	3		N		
88	Fort St James	Whitefish	L	M	RB, LT	5		N		
89	Prince George	Anzac	L	VH	BT, GR, RB, KO	5		N		
90	Prince George	Averil	L	M	CH	1		N		
91	Prince George	Bastille	L	M	BT	3		N		
92	Prince George	Beaverly	M	M	CH	2b	Ag & Hwy	N		
93	Prince George	Blackwater	L	H	RB, CH	5		N		
94	Prince George	Bowron	L	VH	BT, SK, CH, WSG, RB	1		Y	OPM01103	Y
95	Prince George	Captain	L	H	BT, CH	3		N		
96	Prince George	Carp	L	H	RB McLeod R., BT	5		N		
97	Prince George	Cottonwood	L	M	CH	1		N		
98	Prince George	Crooked	M	M	RB, hart lk, BT	1		N		
99	Prince George	Dome	L	H	BT, CH	1		N		
100	Prince George	Fontinako	L	H	BT, CH	3		N		
101	Prince George	Framstead	L	H	BT, CH	3		N		
102	Prince George	Fraser (lower)	L	H	BT, CH, SK	1		N		
103	Prince George	Fraser (upper)	M	H	BT, CH	1		N		
104	Prince George	Gregg	L	M	CH	2b	agriculture	N		
105	Prince George	Haggen	L	H	BT, pinkerton RB, CH	4		N	OPM01103	
106	Prince George	Hixon	M	H	BT, CH	1		N		
107	Prince George	Hominka	L	VH	GR, BT	1		Y	OPM01103	
108	Prince George	Humbug	L	H	BT, CH	1		N		
109	Prince George	James	L	H	BT, CH	3		N		
110	Prince George	Kenneth	L	H	BT, CH	1		N		
111	Prince George	Kitchi	L	M	BT	1		N		
112	Prince George	McGregor (lower)	L	H	BT, CH, WSG	1		N		
113	Prince George	McGregor (upper)	L	M	BT, hedrick RB	1		N		
114	Prince George	McLeod	L	L	N	1		N		
115	Prince George	Missinka	L	VH	GR, BT	1		Y	OPM98111	
116	Prince George	Mud (upper)	L	H	BT, CH	2b	agriculture	N		
117	Prince George	Muskeg	L	L	N	1		N		

118	Prince George	Naver	L	H	BT, CH	1		N		
119	Prince George	Nechako	L	H	BT, CH, SK	2b	Ag & Hydro & Urban development	N		
120	Prince George	Ovington	L	M	BT	3		N		
121	Prince George	Parsnip (lower)	L	VH	BT, GR, LT	5		N		
122	Prince George	Parsnip (upper)	L	VH	BT	1		Y	OPM98111	
123	Prince George	Reynolds	L	VH	GR, BT, RB	5		N		
124	Prince George	Salmon	L	H	BMC, BT, CH	2b	Agriculture	N		
125	Prince George	Seebach	L	H	BT, CH	1		N		
126	Prince George	Slender	L	H	KO, BMC, BT	1		N	OPM01103	
127	Prince George	Slim	L	H	BT, CH	1		N	OPM01103	
128	Prince George	Spakwaniko	L	H	BT, CH	3		N	OPM01103	
129	Prince George	Stuart	L	H	CH, SK, BT, WSG	5		N	OPM01103	
130	Prince George	Table	L	VH	GR, BT, RB	1		Y	OPM01103	Y
131	Prince George	Torpy (lower)	L	VH	BT, CH, WSG	1		Y	OPM01103	Y
132	Prince George	Torpy (upper)	L	VH	BT, LT, CH, WSG	1		Y	OPM01103	Y
133	Prince George	Weedon	L	H	BMC, CMC, LT	1		N	OPM01103	
134	Prince George	Wicheeda	L	M	wicheeda RB, BT	1		N	OPM98111	
135	Prince George	Willow	L	VH	BT, LT, KO, Eaglett Lk sustenance, CH	1		Y	OPM01103	Y
136	Mackenzie	Akie	L	M	BT, KO	3		N		
137	Mackenzie	Blackwater	L	H	GR, BT	1		N		
138	Mackenzie	Chowika	L	VH	BT	3		N		
139	Mackenzie	Clearwater	L	H	GR, BT	1		N		
140	Mackenzie	Collins / Lafferty	L	M	BT	1		N		
141	Mackenzie	Davis	L	VH	GR, BT	1		Y		
142	Mackenzie	Eklund	L	M	BT	1		N		
143	Mackenzie	Factor Ross	L	M	BT	1		N		
144	Mackenzie	Finlay (upper)	L	VH	LT, BT, GR, KO	3		N		
145	Mackenzie	Firesteel	L	VH	unique RB	3		N		
146	Mackenzie	Fox	L	M	GR, BT	3		N		

147	Mackenzie	Frog	L	M	BT	3		N		
148	Mackenzie	Gaffney	L	M	BT	1		N		
149	Mackenzie	Gataga	L	M	BT	3		N		
150	Mackenzie	Germansen	L	H	GR, BT	2b	mining	N		
151	Mackenzie	Ingenika (lower)	L	VH	GR, BT	3		N		
152	Mackenzie	Ingenika (upper)	L	VH	BT, GR, DV	3		N		
153	Mackenzie	Kechika	L	M	BT	3		N		
154	Mackenzie	Klawli	L	M	LT, BT	3		N		
155	Mackenzie	Kwadacha	L	M	BT	3		N		
156	Mackenzie	Mackenzie	M	H	GR, BT	1		N		
157	Mackenzie	Manson	L	M	KO, BT	1		N		
158	Mackenzie	McCusker	L	M	BT	3		N		
159	Mackenzie	McLeod	L	H	BT, RB	1		N		
160	Mackenzie	Mesilinka (lower)	L	VH	GR, BT	1		Y	OPM01603	Y
161	Mackenzie	Mesilinka (Upper)	L	VH	GR, BT	3		N	OPM01603	
162	Mackenzie	Misinchinka	L	VH	GR, BT	1		Y	OPM01603	Y
163	Mackenzie	Nabesche	L	M	GR, BT	1		N	OPM01603	
164	Mackenzie	Nation	L	VH	GR, BT	1		Y	OPM02604	Y
165	Mackenzie	Obo	L	H	GR, BT	3		N		
166	Mackenzie	Omineca	L	VH	GR, BT	2b	mining	N		
167	Mackenzie	Osilinka (lower)	L	VH	BT, GR, LT	1		Y	OPM01603	Y
168	Mackenzie	Osilinka (upper)	L	VH	BT, GR, LT	3		N		
169	Mackenzie	Ospika (lower)	L	M	BT	1		N		
170	Mackenzie	Ospika (Upper)	L	M	BT	3		N		
171	Mackenzie	Paul	L	M	BT	2b	mining	N		
172	Mackenzie	Pelly	L	M	BT	3		N		
173	Mackenzie	Pesika	L	M	BT	3		N		
174	Mackenzie	Philip	L	VH	BT, GR, KO	1		Y		
175	Mackenzie	Russell	L	VH	GR, BT	1		Y	OPM01603	Completed
176	Mackenzie	Schooler	L	H	GR, BT	3		N		
177	Mackenzie	Scott	L	H	GR, BT	1		N		
178	Mackenzie	Scovil	L	L	N	1		N		

179	Mackenzie	Selwyn	L	M	BT	3		N		
180	Mackenzie	South Gataga	L	M	BT	3		N		
181	Mackenzie	Sturdee	L	L	N	2b	mining	N		
182	Mackenzie	Swanell	L	VH	GR, BT	3		N		
183	Mackenzie	Thudaka	L	H	GR, BT	3		N		
184	Mackenzie	Thutade	L	H	BT, DV	2b	mining	N		
185	Mackenzie	Tomas / Carina	L	VH	LT, GR, BT	3		N		
186	Mackenzie	Toodoggone	L	H	GR, BT	3		N		
187	Mackenzie	Tsaydiz	L	H	GR, BT	3		N		
188	Mackenzie	Tutiziki	L	VH	GR, BT	3		N		
189	Mackenzie	Upper Gataga	L	M	BT	3		N		
190	Mackenzie	Weissener	L	M	BT	3		N		
191	Mackenzie	Wicked	L	M	GR, BT	3		N		
192	Fort St John	Aitken Creek/Blueberry River	M	H	GR, CRI	1		Y		
193	Fort St John	Big Arrow Creek	L	H	GR, CRI	3		N		
194	Fort St John	Black Creek/Nig Creek	L	VH	GR	3		N		
195	Fort St John	Boat Creek/Dehacho Creek	L	H	GR	3		N		
196	Fort St John	Buckinghorse River	L	VH	BT, GR, RB	3		N		
197	Fort St John	Cache Creek	M	H	GR	2b	agriculture & oil and gas	N		
198	Fort St John	Cautley Creek/Kahntah River	L	H	GR, CRI	2b	fire & oil and gas	N		
199	Fort St John	Chinchaga River	L	M		3		N		
200	Fort St John	Colt Creek	M	VH	BT, GR, RB	1		Y	OPM01803	Y
201	Fort St John	Conroy Creek	L	H	GR	3		N		
202	Fort St John	Doig River	M	H	GR	3		N		
203	Fort St John	Donnie Creek/Temple Creek	L	H	GR	2b	oil and gas	N		
204	Fort St John	Ettithun River	L	H	GR	3		N		
205	Fort St John	Farrell Creek	M	H	GR, RB	5		N		
206	Fort St John	Graham North	L	VH	BT, GR, RB	3		N		
207	Fort St John	Graham South	L	VH	BT, GR, RB	3		N		

208	Fort St John	Graham-Laurier	L	VH	BT, RB	3		N		
209	Fort St John	Grewatsch Creek/Holman Cr.	L	H	GR, CRI	1		Y		
210	Fort St John	Horseshoe/Bluegrave	M	VH	BT, GR, RB	5		N		
211	Fort St John	Jedney Creek/Beatton River	L	H	GR	2b	oil and gas	N		
212	Fort St John	Katah Creek/Gutah Creek	L	H	GR	3		N		
213	Fort St John	Keily Creek	L	VH	GR	3		N		
214	Fort St John	Kobes Creek/Groundbirch Cr.	M	VH	BT, GR, RB	1		Y	OPM01803	Y
215	Fort St John	Lilly Lake	L	VH	GR	3		N		
216	Fort St John	Lower Beatton/Alces River	VH	VH	BT, GR, PDC, CRI	2b	agriculture & oil and gas & MoTH	N		
217	Fort St John	Lower Cameron River	M	H	BT, GR	2b	agriculture & oil and gas	N		
218	Fort St John	Lower Cypress/Halfway River	M	VH	BT, GR, RB	3		N		
219	Fort St John	Middle Sikanni	L	H	GR	3		N		
220	Fort St John	Middlefork Creek/Medana creek	L	H	GR	3		N		
221	Fort St John	Milligan Creek	M	H	GR	3		N		
222	Fort St John	Niteal Creek/Lower Kahntah R.	L	H	GR	3		N		
223	Fort St John	Osborne River	L	H	PDC	3		N		
224	Fort St John	Sikanni River/Fontas River (A)	L	H	GR	3		N		
225	Fort St John	Sikanni River/Fontas River (B)	L	H	BT, GR, RB	3		N		
226	Fort St John	Trimble Creek/Loranger Creek	L	VH	GR, RB	3		N		
227	Fort St John	Trutch Creek/Horse Range Cr.	L	H	GR	3		N		
228	Fort St John	Umbach Creek	L	H	GR, CRI	2b	agriculture & oil and gas	N		
229	Fort St John	Upper Cameron River	M	H	BT, GR	1		Y		
230	Fort St John	Upper Chowade River	L	VH	BT, GR, RB	3		N		

231	Fort St John	Upper Cypress Creek	L	VH	BT,GR, RB	3		N		
232	Fort St John	Upper Fontas River	L	H	GR, GE	3		N		
233	Fort St John	Upper Halfway River	L	VH	BT, GR, RB	3		N		
234	Fort St John	Upper Sikanni River	L	VH	GR, RB	3		N		
235	Dawson Creek	Beaudette	L	H	BT, GR, RB	3		N		
236	Dawson Creek	Belcourt	L	H	BT	3		N		
237	Dawson Creek	Beryl Prarie	M	H	RB	3		N		
238	Dawson Creek	Burnt River	L	VH	BT, GR, RB	5		N		
239	Dawson Creek	Carbon	L	VH	BT, GR, RB	5		N		
240	Dawson Creek	Dawson Creek	VH	H	GR	3		N		
241	Dawson Creek	Dunlevy	M	VH	BT, RB	3		N		
242	Dawson Creek	Flatbed	L	VH	BT, GR, PDC, BMC	3		N		
243	Dawson Creek	Gething	L	VH	BT, GR, RB	1		Y	OPM01703	Y
244	Dawson Creek	Gwillim	L	VH	BT, GR, RB	3		N		
245	Dawson Creek	Hasler	M	VH	BT, GR, RB	1		Y	OPM01703	Y
246	Dawson Creek	Imperial	L	VH	BT	1		Y		
247	Dawson Creek	Johnson Creek	M	VH	BT, GR, RB	3		N		
248	Dawson Creek	Kinuseo	L	VH	BT, GR	3		N		
249	Dawson Creek	Kiskatinaw	VH	H	GR, RB, CRI	3		N		
250	Dawson Creek	Lake	H	VH	BT, GR, RB, CRI, PDC	3		N		
251	Dawson Creek	Lower Moberly	M	H	BT, GR	3		N		
252	Dawson Creek	Lower Murray	M	H	BT, GR	3		N		
253	Dawson Creek	Lower Sukunka	M	VH	BT, GR, RB	3		N		
254	Dawson Creek	Monkman	L	VH	BT,PW	3		N		
255	Dawson Creek	Narraway	L	H	BT, GR	3		N		
256	Dawson Creek	One Island	VH	VH	GR, RB, FM,BT	2b	agriculture & oil and gas	N		
257	Dawson Creek	Peace River	L	VH	BT, GR, RB	3		N		
258	Dawson Creek	Pine Pass	M	VH	BT, GR, RB	1		Y	OPM98705	Y
259	Dawson Creek	Pine River	H	VH	BT, GR, RB, RDCxFDC	2b	agriculture & oil and gas & MoTH	N		

260	Dawson Creek	Puggins	L	H	BT, GR	2b	agriculture & oil and gas	N		
261	Dawson Creek	Red Deer	L	H	BT	3		N		
262	Dawson Creek	Redwillow	L	H	PDC,RB	3		N		
263	Dawson Creek	Septimus	L	H	BT, GR, RB	3		N		
264	Dawson Creek	Upper Moberly	H	VH	BT, GR, RB	5		N	OPM98705	
265	Dawson Creek	Upper Sukunka	L	VH	BT, GR, RB	1		Y	OPM98705	Y
266	Dawson Creek	Wapiti	L	VH	BT, GR	3		N		
267	Dawson Creek	Williston Lake	L	VH	BT, GR, RB	3		N		
268	Dawson Creek	Wolverine	L	VH	BT, GR	1		Y	OPM01703	Y
269	Fort Nelson	Akue	L	VH	GR,WP	5		N		
270	Fort Nelson	Big Beaver	L	H	BT, GR	1		N		
271	Fort Nelson	Bunch	L	VH	Y	3		N		
272	Fort Nelson	Capot Blanc	L	H	GR	3		N		
273	Fort Nelson	Catkin	L	H		3		N		
274	Fort Nelson	Crehan	L	VH	RB	3		N		
275	Fort Nelson	Crow	L	H		3		N		
276	Fort Nelson	Crusty	L	VH	BT, GR	3		N		
277	Fort Nelson	D'Easum	L	VH	CL	3		N		
278	Fort Nelson	Dilly	L	H		3		N		
279	Fort Nelson	Dunedin	L	VH	GR, PDC	3		N		
280	Fort Nelson	Eight Mile	L	VH	BT, GR	3		N		
281	Fort Nelson	Elleh	L	H	GR	3		N		
282	Fort Nelson	Eskai	L	VH	GR,WP,NP	2b	oil and gas & MoTH	N		
283	Fort Nelson	Etane	L	H		3		N		
284	Fort Nelson	Falk	L	VH	BT, GR	3		N		
285	Fort Nelson	Forcier	L	VH	BT	3		N		
286	Fort Nelson	Ft Nelson R. A	L	H	GR, GE	3		N		
287	Fort Nelson	FT Nelson R. B	L	H	GR, GE	3		N		
288	Fort Nelson	Gammer	L	VH		3		N		
289	Fort Nelson	Gatho	L	VH		3		N		

290	Fort Nelson	Graybank	L	VH	RW	3		N		
291	Fort Nelson	Grayling	L	VH	GR	3		N		
292	Fort Nelson	Hay River	L	M		3		N		
293	Fort Nelson	Hewer	L	VH		3		N		
294	Fort Nelson	Hoffard	L	M		2b	oil and gas	N		
295	Fort Nelson	Holden	L	VH	BT, GR, PDC	3		N		
296	Fort Nelson	Hossitl	L	H		3		N		
297	Fort Nelson	Irene	L	H	GR, PDC	3		N		
298	Fort Nelson	Jackknife	L	VH		3		N		
299	Fort Nelson	July Lake	L	H		3		N		
300	Fort Nelson	Kiwigana	L	H		3		N		
301	Fort Nelson	Kledo	L	VH	BT, GR	1		Y		
302	Fort Nelson	Klowee	L	VH	BT, GR, PDC	3		N		
303	Fort Nelson	Klua	L	VH	WP,NP,MW,GR	1		Y		
304	Fort Nelson	Kwokullie	L	H	WP,NP,MW	2b	oil and gas	N		
305	Fort Nelson	Kyklo	L	M		5		N		
306	Fort Nelson	Labiche	L	H		3		N		
307	Fort Nelson	Liard Hot Springs	L	VH	BT	3		N		
308	Fort Nelson	Liard River A	M	VH	BT, GR, RW, IN	3		N		
309	Fort Nelson	Liard River B	L	VH	BT, GR	3		N		
310	Fort Nelson	Liard River C	L	VH	BT, GR, IN, RW, CM, CA	3		N		
311	Fort Nelson	MacDonald	L	VH		3		N		
312	Fort Nelson	Minaker	L	VH		3		N		
313	Fort Nelson	Moose	L	VH		3		N		
314	Fort Nelson	Moule	L	VH	BT, GR	3		N		
315	Fort Nelson	Muncho	L	VH	BT, GR	3		N		
316	Fort Nelson	Muskwa River A	L	VH	GR, RB	3		N		
317	Fort Nelson	Muskwa River B	VH	VH	BT, GR	3		N		
318	Fort Nelson	Ootta	L	H		3		N		
319	Fort Nelson	Otelsas	L	VH	BT, GR	3		N		
320	Fort Nelson	Patry	L	H		3		N		
321	Fort Nelson	Petitot River	L	VH		3		N		

322	Fort Nelson	Pouce	M	H	GR	2b	oil and gas & MoTH & AG	N		
323	Fort Nelson	Prophet River	VH	VH	BT, GR	3		N		
324	Fort Nelson	Racing	L	VH	BT	3		N		
325	Fort Nelson	Ram	L	VH		3		N		
326	Fort Nelson	Redpott	L	VH		3		N		
327	Fort Nelson	Richards	L	VH		3		N		
328	Fort Nelson	Sahtaneh	L	M		3		N		
329	Fort Nelson	Sandy	L	VH	GR	3		N		
330	Fort Nelson	Scatter	L	VH	BT, GR	3		N		
331	Fort Nelson	Shekilie	L	M		3		N		
332	Fort Nelson	Smith	L	VH	BT, GR	3		N		
333	Fort Nelson	Snake	L	VH	MW,GR,WP,NP,BT	3		N		
334	Fort Nelson	Stanolind	L	VH	GR,WP,NP	1		Y		
335	Fort Nelson	Sulpher	L	VH	BT, GR, IN	3		N		
336	Fort Nelson	Tentsi	L	VH	BT	3		N		
337	Fort Nelson	Tetsa	L	VH	GR	3		N		
338	Fort Nelson	Timberwolf	L	M		3		N		
339	Fort Nelson	Tuchodi	L	VH	BT, RB	3		N		
340	Fort Nelson	Vents	L	VH	BT, GR	3		N		
341	Fort Nelson	Bluff Creek	L	VH		3		N		
342	Fort Nelson	Boreal	L	VH		3		N		
343	Fort Nelson	Braid	L	VH		3		N		
344	Fort Nelson	Chee	L	VH		3		N		
345	Fort Nelson	Coal	L	VH	BT,GR,LW	3		N		
346	Fort Nelson	Frog-Gataga	L	VH	BT,GR	3		N		
347	Fort Nelson	Gemini	L	VH		3		N		
348	Fort Nelson	Gundahoe	L	VH		3		N		
349	Fort Nelson	Kitza	L	VH		3		N		
350	Fort Nelson	Major Hart	L	VH		3		N		
351	Fort Nelson	Matulka	L	VH		3		N		
352	Fort Nelson	Netson	L	VH		3		N		

353	Fort Nelson	Rabbitt	L	VH	BT,GR	3		N		
354	Fort Nelson	Sharktooth	L	VH	BT,GR,RB	3		N		
355	Dawson Creek	Jarvis	L	VH	BT,RB	3		N		

Appendix Table 4. Status of Existing Watershed Projects

Forest District	Watershed Unit		Unit #	IWAP	Overview Assessment			Watershed Restoration Plan		Prescriptions			Major Works			Effectiveness Evaluation			Watershed Status
					Upslope	Riparian	In-Stream	Interim	Full	Upslope	Riparian	In-Stream	Upslope	Riparian	In-Stream	Upslope	Riparian	In-Stream	
	Landscape Unit	Sub-Unit		(P,O, C)	(P,O,C)	(P,O,C)	(P,O, C)	(P, O, C)	(P, O, C)	(P, O, C)	(P, O, C)	(P, O, C)	(P, O, C)	(P, O, C)	(P, O, C)	(P, O, C)	(P, O, C)	(P, O, C)	
Dawson Creek	Gething	-	243	C	P	P	P	P											target
Dawson Creek	Wolverine	-	268	-	P	P	P	P											target
Dawson Creek	Hasler	-	245	-	C	C	C												target
		2 unnamed tribs		-	-	-	-	-	-	-	-	C	-	-	O	O			-
Dawson Creek	Upper Sukunka	-	265		O	O	O	O		O	O	O	P	P	P				target
Dawson Creek	Pine Pass	-	258	C	O	O	O	O		O	O	O	O	O	O				target
		Callazon		-	-	-	-	-	-		O	O		O	O				-
		Silver Sands		-	-	-	-	-	-			C			P				-
Fort St John	Kobes/Groundbirch	-	214	C	C	C	C	O		-	O	O	-	O	O			O	target
		Kobes		-	-	-	-	-	-	-	O	O	-	O	O			O	-
		Groundbirch		-	-	-	-	-	-	-	C	O	-	C	O			O	-
Fort St John	Colt	-	200	C	O	O	O	O			O	O		O	O			O	target
Dawson Creek	Lower Sukunka	Martin	253	-	-	-	-	-	-	-	C	C	-	C	C			O	transition
Robson Valley	Camp Creek	Camp	1		C		C			C		C	C		C				
		Packsaddle			C		C			C			C						
		Gold Crk			C		C			C			C						
		23			C		C			C			C						

Robson Valley	Canoe	Canoe	2		C					C			C						
		Kimmel			C					C			C						
Robson Valley	Castle		4		C		C			C		C	C		C	P		P	
Robson Valley	Dawson	Dawson	6		C					C			C			P			
		Harvey			C					C			C						
Robson Valley	Dore		7																
		Boreal Crk			C					C			C			P			
		Middle Dore			C					C			O						
		Main Dore			C					C			C						
		South Dore			C					C			C						
Robson Valley	Foster	Windfall	10		C					C			C			P			
		Howard			C					C			C						
Robson Valley	Milk	Milk	19	C	C					P			P						
Robson Valley	Goat	Goat	11	C	C														
Robson Valley	Holmes	Holmes	12		C	C	C	C	P	C	P	P	O	P	P	P	P	P	target
		Chalco			C	C	C	C	P	O	P	P	P	P	P	P	P		target
Robson Valley	Horsey/Small	Horsey	13		C		C			C		C	C		C	P		PU	
		Small			C					C			C			C			
Robson Valley	Hugh Allan		14		C					C			C						
Robson Valley	Kinbasket (east)	Ptarmigan	15		C		C			C			C			PU			
		Horse			C					C			C						
		Dave Henry			C					C			O			PU			
		Bulldog			C					C			C			PU			
		A-Roads			C					C			O						
		B-Roads											C						
		C-Roads			C					C			O						
		U-Roads			C					C			O						

		E. Canoe	36k		C					C			O						
Robson Valley	Kinbasket (west)	Grouse	16		C					C			C			PU			
		100			C					C			C						
		106			C					C			C						
Robson Valley	Kiwa/ Tete Jaune	Kiwa	17		C		C			C		C	C		C	O		PU	
Robson Valley	McBride/Dunster		18		O	O	O		P										target
		Dominion		C	C	O	O			C			O						target
		Martinson		C	C	O	O			O			O						target
Robson Valley	Trench (northern)		24																
		West Twin			C					C			C			P			
		Legrand			C					C			C			P			
Robson Valley	Trench (southern)		25																
		Swift Crk			C		C			C			C			P			
		McLennan			C		C			C		C	C		C	P		PU	
Vanderhoof	Blackwater		26																
		Naglico			C	C													
		Suscha			C	C													
		Tsacha			C	C													
Vanderhoof	Chilako		27																
		Bobtail			C	C				C			C			P			
		Chilako			C	C				C			C			P			
		Gluten			C	C				C			C			P			
Vanderhoof	Cluculz		28				C					C			C			PU	
		Cobb			C	C													
		Hulatt			C	C													
		Lower Cluculz			C	C	C												
		Upper Cluculz			C	C					C	C		C	C		PU	PU	
		Norman			C	C													
Vanderhoof	Endako		29																
		Endako			C	C				P	P								

		Justine			C	C				P	P								
		Oona			C	C				P	P								
		Ormond			C	C				P	P								
		Shovel			C	C				P	P								
		Stellako			C	C				P	P								
		Stern			C	C				P	P								
		Tatlin			C	C				P	P								
Vanderhoof	Entiako		30																
		Capoose			C	C													
		Van Tine			C	C													
Vanderhoof	Fawnie		31																
		Cow			C	C													
		Fawnie			C	C													
		Laidman			C	C													
		Johnny			C	C													
		Malaput			C	C													
		Matthew			C	C													
		Moose			C	C													
Vanderhoof	Greer		32																
		Cutoff			C	C	C												
		Lower Greer			C	C	C												
		Upper Greer			C	C	C												
		Swanson			C	C	C			C	C	C	C	O	C	P	PU	PU	
Vanderhoof	Hallet		33																
		Cabin			C	C													
		Holy Cross			C	C													
		Smith			C	C	C			C	C	C							
		Targe			C	C													
		Tahultzu			C	C													
Vanderhoof	Jerryboy		34																
		Euchinko			C	C													
		Taiuk			C	C													
Vanderhoof	Kluskus		35																
		Bigbend			C	C	C			C	C	C	C	C	C	P	P	P	
		Earhorn			C	C													

Vanderhoof	Lucas		36																
		Cicuta			C	C													
		Lucas			C	C						C			C			PU	
		Yellow Moose			C	C													
Vanderhoof	Nechako		37				C												
		Chilco			C	C													
		Clear Creek			C	C													
		Kluk			C	C													
		Knight			C	C													
		Murray			C	C													
		Nine Mile			C	C													
		Trankle			C	C													
Vanderhoof	Nithi		38																
		Anzus			C	C				P	P								
		Beaumont			C	C				P	P								
		Francois			C	C				P	P								
		Nithi			C	C				P	P								
		Robertson			C	C				P	P								
Vanderhoof	Sinkut		39																
		Hogsback			C	C													
		Lower Sinkut			C	C	C												
		Upper Sinkut			C	C	C												
Vanderhoof	Stony		40																
		Croft			C	C													
		Corkscrew			C	C	C			C	C	C	C	C	C	P	P	PU	
		Engen			C	C													
		Goldie			C	C													
		Lower Stoney			C	C													
		Upper Stoney			C	C													
		Nulki			C	C	C					C			C			PU	
		Rorison			C	C													
		Tatsuntnai			C	C													
		Tachick			C	C	C					C			C			PU	

Vanderhoof	Stuart		41																
		Bearcub			C	C				P	P								
		Breadalbane			C	C				P	P								
		Burnstead			C	C				P	P								
		Dog Creek			C	C				P	P								
		Kec Creek			C	C				P	P								
		Pitka			C	C				P	P								
Vanderhoof	Sutherland		42																
		Charlotte			C	C				P	P								
		Duncan			C	C				P	P								
		Mid Sutherland			C	C				P	P								
		Upp Sutherland			C	C				P	P								
Vanderhoof	Tatelkuz		43																
		Chedakus			C	C													
		Davidson			C	C													
		Kuyakuz			C	C													
		Swollaf			C	C													
		Tatelkuz			C	C													
Vanderhoof	Tatuk		44																
		Finger			C	C	C			C	C	C	O	O		PU	PU		
		Tatuk			C	C	C			C	C	C	O	O		PU	PU		
		Turff			C	C													
		Willington			C	C													
Fort St. James	Bear Lake		46		P	P	P												
Fort St. James	Beaver/Salmon		47		P	P	C					O			P				
Fort St. James	Chuchi		48		O	O	C		P			C	PU		PU				target
Fort St. James	Cunningham		49		P	P	P												
Fort St. James	Upp Driftwood/Kostine		50				C					C			PU				
Fort St.	Dust		51		P	P	P												

James	Creek																		
Fort St. James	Duti River		52		P	P	P												
Fort St. James	East Takla Lake		53		O	P	C			P	P	P	P	P	P				
		Hudson Bay																	
Fort St. James	Fall/Silver		54			C	C			PU	PU	PU							
Fort St. James	Fort St.James		55																
		Nahounli			C		C					C			C			PU	
Fort St. James	Fry Pan		56		O	C	C			PU	PU	PU							
		Ankwill																	
Fort St. James	Grostete/Hat		57		P	P	P			P	P	P	P	P	P	P	P	P	
Fort St. James	Inzana		58		O	P	C			P	P	P	P	P	P	P	P	P	
Fort St. James	Lion/Katsberg		61		O	P	C			P	P	C	P	P	O	P	P	PU	
Fort St. James	Lovell		62		O	P	C			P	P	C	P	P	O	PU	PU	PU	
Fort St. James	Middle A		63		O	O	O		P	PU	PU	PU							
Fort St. James	Middle B		64		O	O	O		P	PU	PU	PU							
Fort St. James	Nation (North)		65		P	P	C			P	P	P	P	P	P	P	P	P	
Fort St. James	Necoslie		66			P	P			P	P	P	P	P	P	P	P	P	
Fort St. James	Omineca Headwaters		67				C												
Fort St. James	Pinchi		69		P	P	C			P	P	O	P	P	P	P	P	P	
Fort St. James	Sakenichie		70		P	P	P			P	P	P	P	P	P	P	P	P	
Fort St. James	Salmon (North)		71		O	P	C			P	P	O	P	P	P	P	P	P	
Fort St. James	Sowchea		77		P														
Fort St. James	Tachie River		81		O	O	O		P	P	P	P							
Fort St.	Tchentlo		82		P	P	C			P	P	P	P	P	P	P	P	P	

James	25																		
Fort St. James	Tchentlo 27		83		O	P	C			P	P	P	P	P	P	P	P	P	
Fort St. James	Tezzeron		84		O	P	P			P	P	P	P	P	P	P	P	P	
Fort St. James	TFL42		85		O	P	P			P	P	P	P	P	P	P	P	P	
		Tarnezell			C														
Fort St. James	Whitefish		88		P	P	P			P	P	P	P	P	P	P	P	P	
Prince George	Anzac		89		C					P									
Prince George	Averil		90		C					P									
Prince George	Bastille		91		C					P									
Prince George	Beaverly		92		P														
Prince George	Blackwater		93		P														
Prince George	Bowron		94		O	O	O		PU	O	O	O	O	O	O	P	P	P	target
		Littlefield			C	C	C			C	C	C	C	C	C	P	P	P	
		Wolverine								C									
		Bencher								C		C	O		O	P		P	
		Haggen											C			P			
		Beaver											C			P			
Prince George	Captain		95		C					P									
Prince George	Carp		96		P														
Prince George	Cottonwood		97		C														
Prince George	Crooked		98		P														
Prince George	Dome		99		C	C	C			C	C	C	C			P			
Prince George	Fontinako		100		P														
Prince George	Framstead		101		P														
Prince	Fraser (Lower)		102		P														

George																			
Prince George	Fraser (Upper)		103		P														
Prince George	Gregg		104		P														
Prince George	Haggen		105		C					P						P			
Prince George	Hixon		106		C					P						P			
		Stone			C					C			C			P			
Prince George	Hominka		107		C	C	C		P	P	P	P							
Prince George	Humbug		108		P		C			C			P						
Prince George	James		109		P														
Prince George	Kenneth		110		P	C	C					C			PU				
Prince George	Kitchi		111		C					P									
Prince George	McGregor (lower)		112		P														
Prince George	McGregor (upper)		113		C					P									
Prince George	Mcleod		114		C					C			P						
Prince George	Missinka		115		C	C	C		P	P	PU	PU							
Prince George	Mud (Upper)		116		C					P					O				
Prince George	Muskeg		117		P														
Prince George	Naver		118		C		C			C		C	C		C	O		PU	
Prince George	Nechako		119		P														
Prince George	Ovington		120		P														
Prince George	Parsnip (lower)		121		P		C												
Prince George	Parsnip (upper)		122		C	C	C		P	P									
Prince George	Reynolds		123		P														

Prince George	Salmon		124		P														
Prince George	Seebach		125		C					P									
Prince George	Slender		126		P														
Prince George	Slim		127		P														
Prince George	Spakwaniko		128		P														
Prince George	Stuart		129		P														
Prince George	Table		130		C	C	C		O	P	P	C			O			P	target
Prince George	Torpy (Lower)		131		C		C		O	C	P	O	O	P	O	P	P	P	target
Prince George	Torpy (Upper)		132		C		C		O	P	P	C			O			P	target
Prince George	Weedon		133		P														
Prince George	Wicheeda		134		C		P			O		O	O		O	P		P	
Prince George	Willow		135		C	O	O		O	O	O	O	O	O	O	P	P	P	target
		Wansa					C			C									
		Tabor					C												
		Narrowlake Crk										O			O			P	
		Zappa										O			O			P	
		Thursday										C			C			P	
Mackenzie	Blackwater		137		C					C			P						
Mackenzie	Chowika		138																
		Ivor			C					C			P						
		Police			C					C			P						
Mackenzie	Clearwater		139							C			C						
		Point											C						
		Fast											C						
		Cold											C						

Mackenzie	Collins/Lafferty		140										P						
Mackenzie	Davis		141																
		Davis					C			C	P		P						
		Shovel			C					C			P						
Mackenzie	Gaffney		148		C					C			P						
Mackenzie	Germansen		150		C					C									
Mackenzie	Ingenika (lower)		151		C					C			P						
Mackenzie	Klawi		154		C														
Mackenzie	Mackenzie		156		C					C									
Mackenzie	Manson		157																
		Manson			C		C		O	O	P	P	P			P			
		Munro			C	C	C		O	C	P	P	C			O			
Mackenzie	McLeod	Reed	159										C						
		Lignite											C						
Mackenzie	Mesilinka (lower)	Culvert Crk.	160		C	C	C		O	O	P	C	P	P	P	P	P	P	target
		Prospector Crk			C	C	C		O	P		C	C	P	PU	P	P	P	
		Lower Mesilinka			C	C	C		O	C	C	C	O	P	C	P	P	P	
		Control Crk.			C	C	C		O	O	P	C	P	P	P	P	P	P	
		Residual # 1			C	C	C		O	O	C	C	C	P	P	P	P	P	
Mackenzie	Mesilinka (upper)		161																
Mackenzie	Misinchinka		162		C	C	C		O	O	O	O	P	P	P	P	P	P	target
Mackenzie	Nabeshce		163		O	O	O		O	P	P	P							
Mackenzie	Nation		164		C	C	C		O	O	O	O	P	P	P	P	P	P	target
Mackenzie	Osilinka (lower)	Tenakihi	167		C	C	C		O	O	O	O	P	P	P	P	P	P	target
Mackenzie	Philip		174		C					C			P						
Mackenzie	Russell		175		C	C	C												
Mackenzie	Scott		177		O	O	O		O										
Mackenzie	Swanell		182		P	P	P												
Mackenzie	Tsaydiz		187		P	P	P												
Mackenzie	Tutiziki		188		P	P	P												

Appendix Table 5. Identification of Effectiveness Evaluation Needs for WRP

Effectiveness Evaluation Issue & Potential Benefits	Type of Effectiveness Evaluation			Category (1, 2, 3)	Estimated 2002-03 Funding required ($)	Estimated Term of evaluation (years)
	Routine	Intensive	Operational Techniques Refinement			
Willow/Narrowlake Creek (Instream/riparian Demo Site)/ Application refinement	X			2	10,000	1,3,5
Willow/Narrowlake Creek Tributary 1 (alias Zappa)/	X		X	3	5,000	1,3,5
Willow/ Thursday Creek/ review of sub-contracted instream works	X			3	5,000	1,3,5
Lower Mesilinka/ Culvert Creek Instream works	X			3	5,000	1,3,5,
Residual # 1 (Lower Mesilinka)	X			3	5,000	1,3,5,
Lower Mesilinka (Instream, Riparian, Upslope)	X			3	5,000	1,3,5,
Control Creek (Instream)	X			3	5,000	1,3,5,
Castle (upslope)	X			2		
Dawson (upslope)	X			2		
Dore (upslope)	X			2		
Nahounli (instream) evaluation of objectives/ application refinement	X			2	5,000	3,5
Swanson (off-channel sedimentation/utilization) Ensure ulitlization	X			2	5,000	3,5
Big Bend Creek (Sediment source stabilization) Ensure effectivness	X			2	5,000	1,3,5
Lucas Bridge (sediment and hydraulics) Ensure that there are no issues	X			2	5,000	3,5
Corkscrew (Instream and riparian) Ensure objectives continue to be met	X			2	5,000	3,5
Naver				2	5,000	1,3,5
Table River Tribs (instream works) increase habitat, reduce erosion	X			3	15,000	1,3,5
Torpy Fish Passage and Instream works	X			2 and 3	15,000	1,3,5
Wicheeda (bridge removal) evaluation of sediment concerns	X			2	5,000	1,3,5
Ford sites at **18 Mile and 14 Mile Creeks** - 18 Mile has Tri-lock installed on the approaches, 14 Mile has Geocel installed on the approaches. Both of these sites should have operational techniques evaluation to determine			X	2	1000/YR	3 to 5

the integrity of the crossings and mitigation of water quality/habitat impacts due to the improved approaches. **Both installations are new techniques.**						
Bencher Slide Site - This site will be receiving considerable works this season to reduce significant bedload movement and sediment deposition to a tributary of the Bowron River. The works will include re-channelizing portions of the creek and the installation of checkdams. This site may also affect turbidity measurements being taken in close proximity. Instream applications require effectivness evaluations	X	X		3	5,000	5 to 7
Everette Creek @ km 45.3 on the Bowron/Tumuch FSR - This site has had considerable upslope works done to rehabilitate road and on-block erosion that has resulted in the deposition of sediment in the floodplain of Everette Creek. Routine evaluations should continue to be conducted, and potentially Intensive evaluation may be warranted. Based on the deposition zone, measurements to validate the anticipated reduction of upslope sediment migration would be easily accomplished.	X			2	2,000	3 to 5
Bio-engineering works at Wansa Creek on the Willow Coalmine - A side-channel at this site received some bio-engineering works to stabilize the toe of the road's fill slope. Besides the stabilization effort, another objective was to re-establish cover. The achievement of these objectives should be measured and evaluated.			X	2	500	3 to 5
Cedex Road just past the Kenneth Creek Crossing - Considerable work was done at this site to stabilize the creek bank (and toe of road slope) using rip rap. Extensive cutslope bio-engineering was installed to provide stabilization, drainage uptake and to re-establish vegetation ground cover. 6 large conifers were also planted (3 at each end of the rip rap work). These should be monitored also. The bio-engineering utilized cuttings primarily, however, rooted stock was also planted. This site will provide good data regarding the use of the different plantings and their regeneration progress.			X	2	500	3 to 5
Bowron River Watershed - all worked on sub-basins, including	X	X		all	5,000	3 to 7

Wolverine Creek (Cariboo River W-Shed). Upslope works have been completed in many sub-basins. These works should be routinely monitored and evaluated, with the view towards intensive sites where AM principles could be applied.						
Willow River Watershed - all worked on sub-basins. Upslope works have been completed in many sub-basins. These works should be routinely monitored and evaluated, with the view towards intensive sites where AM principles could be applied.	X	X		all	5,000	3 to 7
Upper Parsnip - all worked on sub-basins. Upslope works have been completed in the Wichika and Table sub-basins. Both should be routinely monitored and evaluated.	X			2	2,000	3 to 7
Mcleod Lake/Tsatchuka Area Although this area has been assigned to the local First Nations, the works should be monitored and evaluated.	X			2	1,500	3 to 5
Stone Creek Watershed Routine monitoring and evaluation.	X			2	500	3 to 5
TFL 030 - all worked on sub-basins. Routine monitoring and evaluation.	X			2,3	1,000	3 to 5
TFL 053 - all worked on sub-basins. Routine monitoring and evaluation and follow-up on the existing procedures developed by Dobson Engineering. These works should be routinely monitored and evaluated, with the view towards intensive sites where AM principles could be applied.	X	X		1,2	2,000	3 to 5
Torpy Watershed Routine monitoring and evaluation.	X			2	500	3 to 5
Chilako River Watershed - all worked on sub-basins. Upslope works have been completed in many sub-basins. These works	X	X		1,2	5,000	3 to 7

should be routinely monitored and evaluated, with the view towards						
intensive sites where AM principles could be applied.						
Slim and Dome Creek Watersheds	X			2	2,000	3 to 5
Both of these watersheds have received some upslope works in the early						
stages of the WRP. Neither of them have had follow-up visits or any routine						
monitoring.						
Hasler (instream, riparian, upslope)	X			2	5,000	1,3,5
Pine Pass (instream, riparian, upslope)	X			2 and 3	10,000	1,3,5
Kobes/Groundbirch (instream, riparian, upslope)	X			1, 2, and 3	10,000	1,3,5
Colt (instream, riparian, upslope)	X			1		3,5
Lower Sukunka (Martin Creek instream restoration)	X			1		
Upper Halfway and Upper Beatton (evaluate the effectiveness of bottomless arch installation with and without pilings)			X	2 and 3	20,000	1,3,5
				Total	**182,500**	